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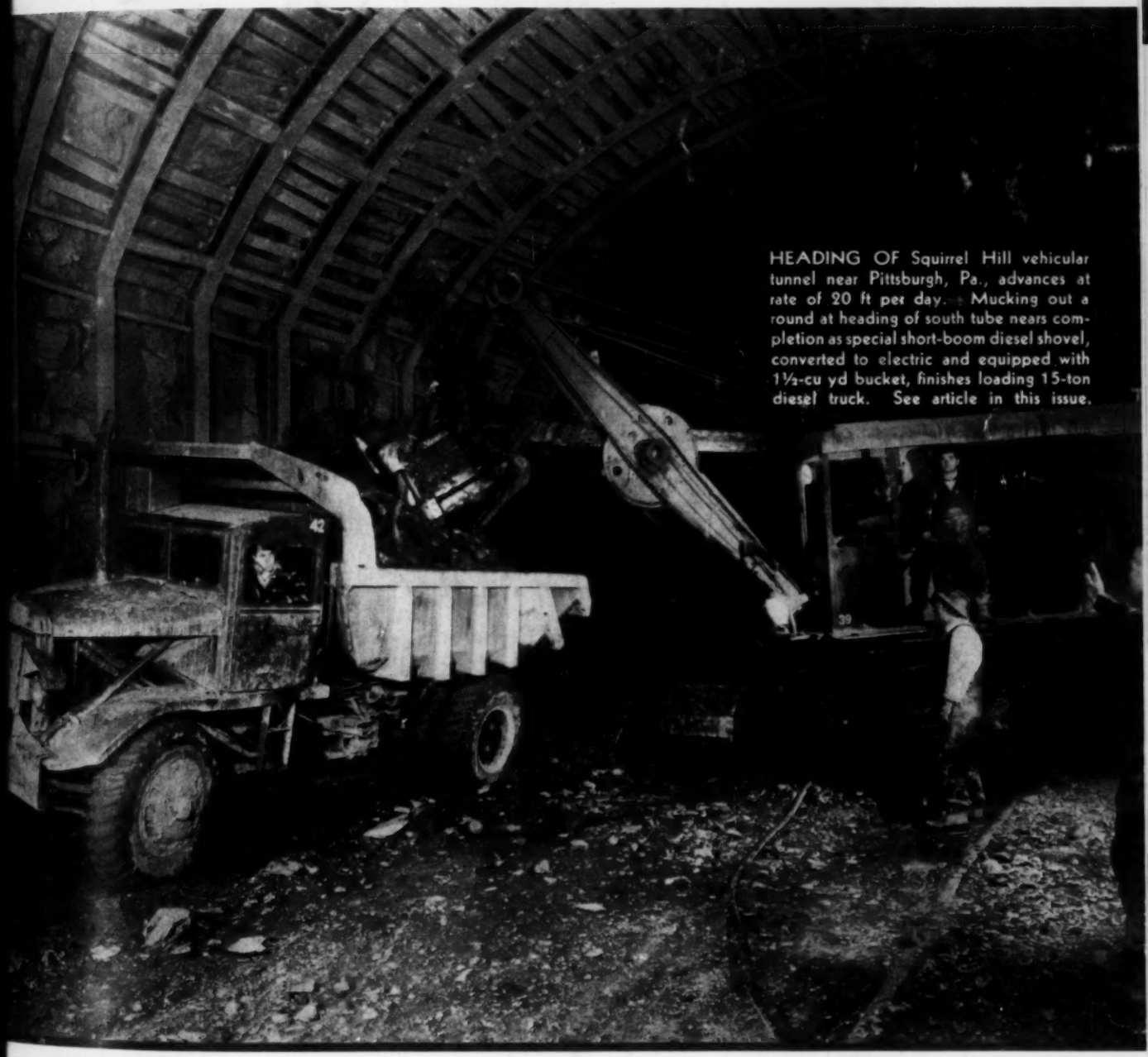
CIVIL ENGINEERING

THE MAGAZINE OF ENGINEERED CONSTRUCTION



HEADING OF Squirrel Hill vehicular tunnel near Pittsburgh, Pa., advances at rate of 20 ft per day. Mucking out a round at heading of south tube nears completion as special short-boom diesel shovel, converted to electric and equipped with 1½-cu yd bucket, finishes loading 15-ton diesel truck. See article in this issue.

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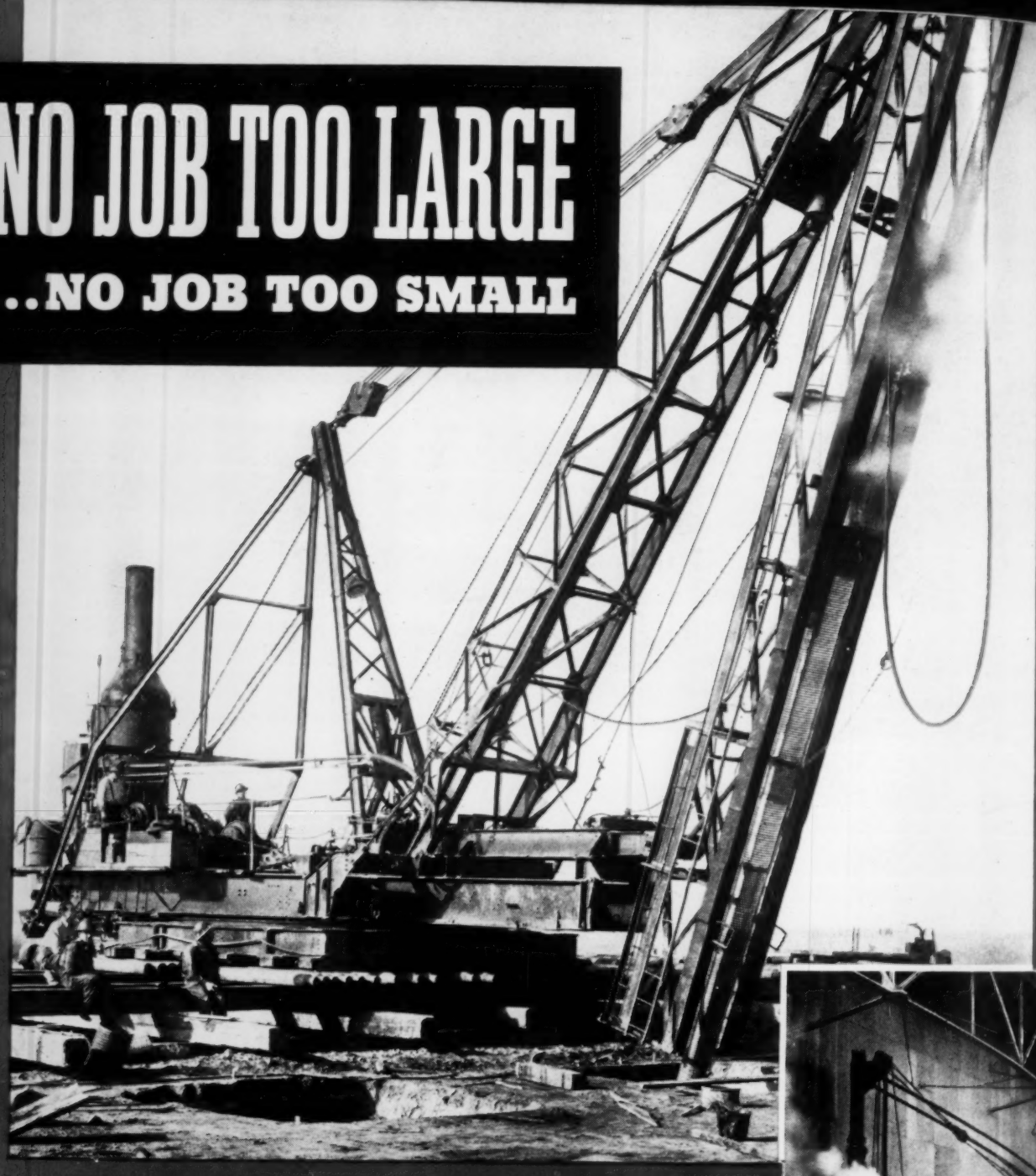

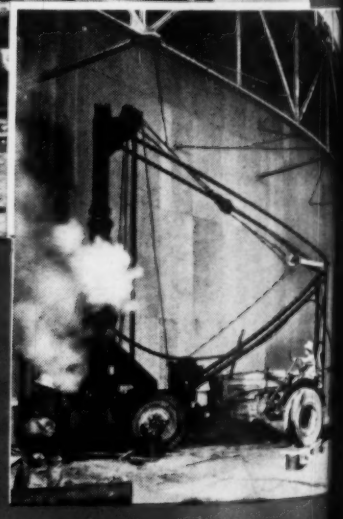

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Incinerator Mechanization Wins Increasing Favor

ROLF ELIASSEN, M. ASCE

Professor of Sanitary Engineering, College of Engineering, New York University, New York, N. Y.

THREE-STORY bin-and-crane type incinerator at Lyttonsville, Md., has adequate turn-around area for trucks on receiving side.

DISPOSAL OF MUNICIPAL REFUSE, including garbage, has been a problem ever since men began to live in communities. In New York City the staggering total of 30 million cu yd of refuse is collected and disposed of in a year. American cities generally use incinerators, hog farms and sanitary fills. Larger cities prefer incinerators for garbage and combustible rubbish, and land fills for ashes and non-combustibles. High costs of incineration can be offset, at least in part, Professor Eliassen believes, by substituting modern mechanical handling equipment for manpower in plants, by recovering and using waste heat, and by giving careful attention to every potential operating economy of the plant. Professor Eliassen is chairman of the Committee on Refuse Collection and Disposal of ASCE's Sanitary Engineering Division.

INCINERATION of community refuse has now completed a cycle of favor, disfavor, and return to favor. During the 1920's more incinerators were installed than in any other decade. In the 1930's the trend was away from incinerators toward sanitary land fills. During World War II the cycle was reversed as hundreds of incinerators were installed in Army camps. The present trend in municipal refuse disposal practice is toward a wider adoption of incinerators, as evidenced by the number of cities which now have studies and designs under way.

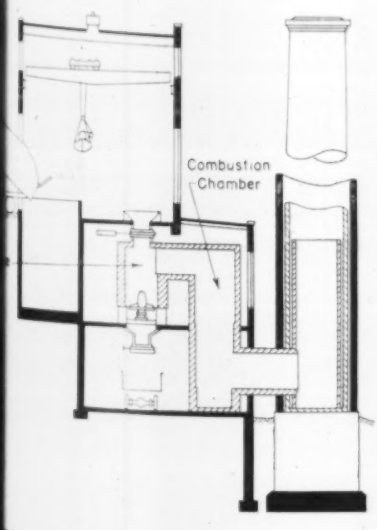


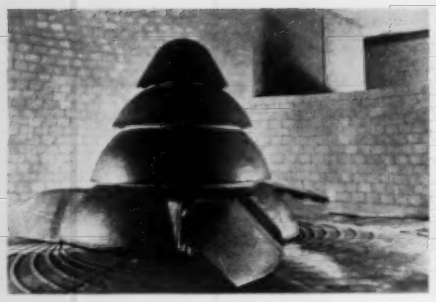
FIG. 1. CROSS SECTION through three-story bin-and-crane type incinerator with single-hearth cylindrical furnace indicates method of operation. Trucks dump into bin at left; overhead crane charges furnace; and truck below removes ashes. Two-unit, 250-ton-per-day plant of this type was recently completed for Troy, N.Y., by Nichols Engineering and Research Corp. after plans by R. T. Westbrook.

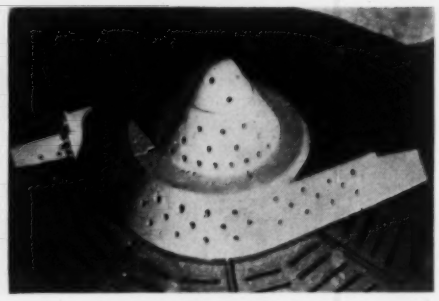
Garbage reduction was highly in favor prior to and during World War I, when a good number of reduction plants for municipal garbage were installed. These plants employed many variations of the processes of grease extraction, separation of water and solids, and the preparation of a dry residue for fertilizer or as a basis for animal feed. Some plants are still in operation in larger cities in the United States but for many years the problems of odors, fire hazards, and sporadic markets for the products of garbage reduction have served to eliminate its consideration in new plants.

Fermentation Processes Being Tried

Fermentation of garbage by the Beccari System met with success in Europe around 1920 in producing a humus-like fertilizer following the aerobic oxidation of much of the unstable organic matter. The process met with little recognition in the United States largely because of the uncertainties of operation and the high costs of the concrete cells required to retain the garbage for 30 to 50 days.

The fermentation process has since been modified by Verdier of Cannes, France. Instead of accepting only garbage, the Verdier process provides for the grinding of all the refuse collected, including paper, glass, street sweepings, leaves, and garbage. Mechanical equipment for grinding and conveying the refuse to fermentation





RABBLE ARMS, rotating at six revolutions per hour, stir and push dried refuse outward onto burning grates in mechanical stokers recently installed in modern incinerator furnaces. Sidney, Ohio, incinerator (above left), is equipped with Morse Boulger single-hearth furnace and stoker, and Beverly Hills, Calif., incinerator (above right) has Nichols single-hearth furnace and stoker.

cells has reduced labor costs. Control of the process is achieved by recirculation of the liquor containing the microorganisms which accomplish fermentation, and by mechanical aeration to provide an aerobic environment for the organisms.

Verdier has claimed that these developments have served to make the process odorless and economical. Detention time has been cut in half as the mixed refuse is converted into a humus-like fertilizer which finds a ready market. The City of Miami, Fla., is preparing plans for the installation of a plant using the Verdier process for the disposal of its mixed refuse.

Although the feeding of raw garbage to hogs has been condemned by many public health authorities as a distinct menace to health, it is still widely used for garbage disposal. Reports of the U. S. Public Health Service (Control of Trichinosis, April 9, 1948, page 478) have indicated that approximately 5 percent of garbage-fed hogs are infected with trichinosis and that these hogs are the vital factor in the transmission of the disease to humans. In order to kill the trichinosis organism, all garbage should either be frozen or boiled before being fed to hogs. The added expense of freezing or boiling stations reduces the net monetary return on the sale of hogs or garbage. Until a dollar value can be placed on the menace of trichinosis to public health, it will be difficult to persuade municipal officials to legislate to abandon hog feeding in favor of other methods of garbage disposal more in accord with modern standards of public health engineering.

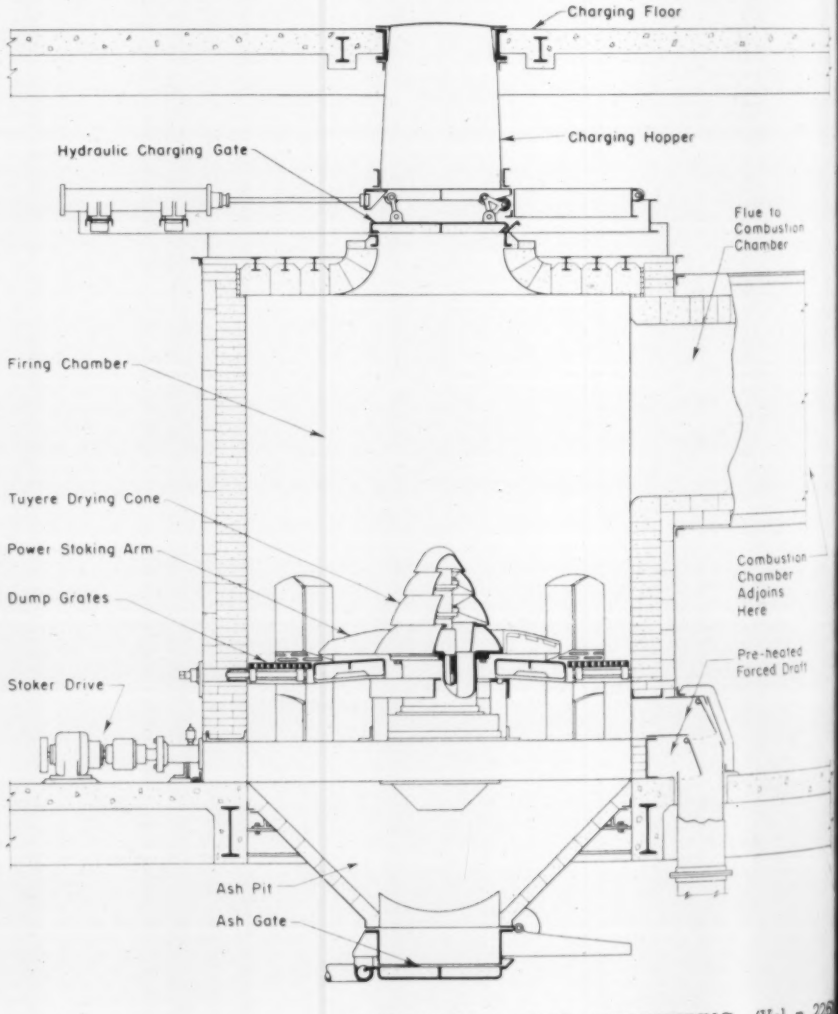
Reclaim Waste Lands with Sanitary Fills

Sanitary land fills are finding favor among many municipalities which have adequate waste land available within reasonable hauling distances. The use of modern earth-moving equipment such as bulldozers, bull-clam shovels and draglines has brought about economies in the preparation of fill sites and placing of cover material. Constant vigilance on the part of supervising engineers and waste disposal superintendents is necessary to assure the daily covering of refuse with a minimum depth of 2 ft. Without adequate supervision, a land fill reverts to an open or burning dump, with all the attending nuisances of odor, smoke, rat harborage, and other factors injurious to public health.

One of the major assets of well operated sanitary land fills is the reclamation of waste land, especially for open areas such as parks and storage yards. Buildings should not be constructed on the fills unless broad mat foundations are used to minimize local settling. Precautions must be taken to prevent the diffusion of the gases of decomposition, particularly methane, into entrapped areas under or within buildings, as serious explosions have occurred in buildings constructed on land fills. Since decomposition may continue for thirty years or more, time-after-filling is not a factor in the consideration of land use.

Sanitary land fills are necessary for the final disposal of incinerator ashes and non-combustible refuse such as

FIG. 2. **SECTION** through refuse incinerator building for Staunton, Va., shows mechanical stoking facilities for handling 60 tons per day. Plant, designed in City Engineer's office, was placed in operation in 1949. Furnace was designed and built by Morse Boulger Destructor Co.



glass and metal. Many cities use such fills in conjunction with incinerators, which can be centrally located so as to reduce the costs of collection. As these costs are the major item in the total cost of refuse collection and disposal, refuse disposal sites must be carefully selected. Although land fills may be less expensive to operate than other methods such as incinerators, the remoteness of land-fill sites may result in high hauling costs which will nullify the anticipated savings.

Modern Incinerators Economical and Sanitary

Incinerators, when properly designed and operated, are proving to be one of the most satisfactory means for the destruction of combustible refuse—which includes garbage. The principal factor in their return to popularity is the adoption of labor-saving mechanical equipment for the efficient handling of refuse and ashes. Another factor is the exhaustion of available areas for sanitary land fills within reasonable hauling distances. This return to favor of incinerators is indicated in a recent survey of the U. S. Public Health Service, which showed that in the near future 1,090 new incinators would be required for municipal use throughout the United States.

High construction and operating costs are the greatest factors standing in the way of more widespread installation of municipal incinerators. The U. S. Public Health Service estimated that the incinerators cited above would cost approximately 100 million dollars. Cost figures are not easily evaluated over wide ranges of sizes, but bids taken during 1947 and 1948 indicated that the range of construction costs for incinerator plants was from $150,000 to $250,000 per 100-ton capacity per 24-hour day. Operating costs may range from 50 cents to $1.50 per ton of refuse destroyed. These latter costs have been mounting in recent years.

Mechanization of incinerator plants offers the only solution presently available for reducing the cost of incinerator operation. Modern materials handling equipment is particularly applicable to the charging of incinerators. The old method of dumping refuse from collection trucks directly onto the charging floor not only requires a staff of laborers to handle the refuse from the point of dumping to the charging chute, but also leads to fire hazards and frequent delays while collection trucks await their turn to dump. Larger floors for dumping may mean shorter truck delays but may lead to higher labor costs.

A storage pit for refuse, together with mechanical loading equipment and charging hoppers on the incinerators, will save considerable labor, provide more uniform loading of incinerators, and permit rapid unloading of collection trucks. Larger plants may employ a bridge crane and clamshell which can be operated by one man.

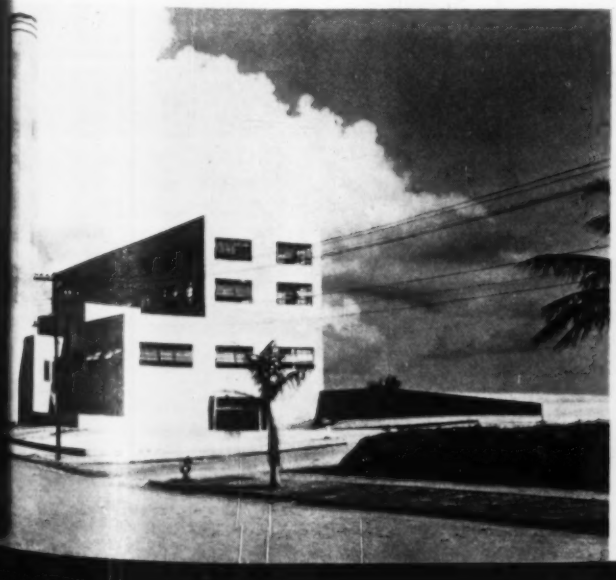
Many average-size communities cannot afford bridge cranes and must resort to simpler equipment. Single-line buckets with electric hoists and motorized trolleys have been used successfully in transferring refuse from the dumping pits to the feed hoppers of incinerators. Other plants use a skip and hoist, somewhat similar to that employed on a concrete mixer, but on a larger scale. The ingenuity and experience of materials handling engineers must be called upon by designing engineers to assist them in expediting the handling of refuse at the incinerator site. Capital expenditures of reasonable sums can more than pay for themselves by increased savings in labor costs.

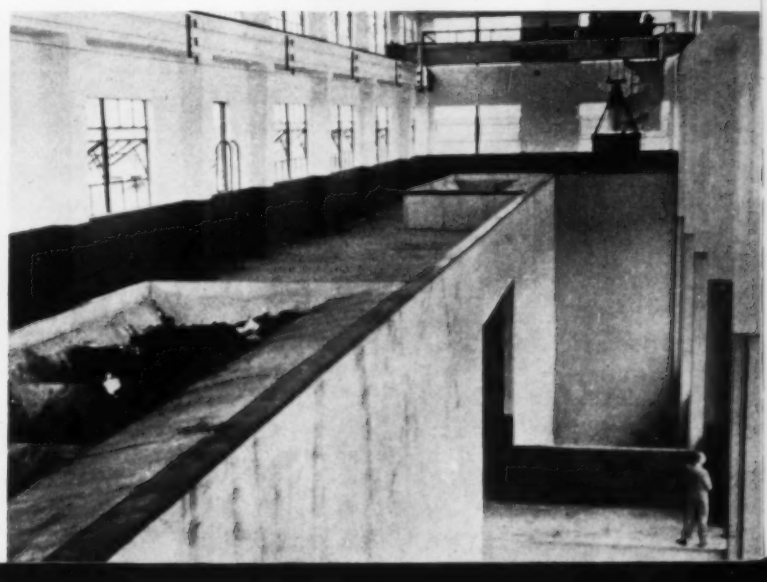
Mechanization of incinerator furnaces has also decreased labor costs. The most significant development in this field has been the design of mechanical stokers to handle combustible refuse and to provide a better distribution of air within the furnace. Metallurgical research has led to the perfection of iron alloys which will resist abrasion at high temperatures. By utilizing these alloys, two manufacturers have developed mechanical stokers for circular furnaces. Such furnaces, which are essentially vertical cylinders varying in outside diameter from 9 to 15 ft, have been designed to burn from 40 to 200 tons of mixed refuse in 24 hours. Approximately 25 plants using mechanical stokers in circular furnaces have been built since 1942.

Mechanical stoking is accomplished by means of rabble arms, two or three in number, which rotate at about 6 revolutions per hour to agitate the refuse and move it toward the periphery of the furnace. The central portion of the furnace floor consists of a flat circular steel plate which serves as the drying hearth and occupies approximately half of the horizontal projected area of the furnace. The drying hearth serves as the bed plate over which the stoking arms rotate, as shown in Figs. 1 and 2. Beyond the arms, and extending completely around the drying hearth is the burning hearth, composed of grates through which air for combustion is furnished. All the grates are designed for mechanical dumping and are controlled from the stoking floor of the plant.

One of the novel features of this type of equipment is the use of the central cone and stoking arms for the introduction of air into the mass of refuse piled over the cones and directly under the charging hopper. It is claimed that this feature of air distribution, as well as the regular stoking, increases burning rates.

IN MODERN THREE-STORY bin-and-crane incinerator built for Trujillo, Dominican Republic (below, left), trucks dump into pit, on right in interior view of plant (below right), and crane-bucket transfers refuse from pit to charging hoppers on high platform at left, located over furnace units.





Tests conducted at Detroit, Mich., Tonawanda, N.Y., and Winnipeg, Canada, showed that higher burning rates may be utilized with this type of incinerator than with the conventional manually stoked unit. The latter is usually designed for 50 lb of refuse per hour per sq ft of projected furnace area. In contrast, the mechanically stoked incinerators at Tonawanda and other cities are designed for a loading rate greater than 100 lb. Acceptance tests proved that this design rate can readily be met.

Further studies by impartial committees of engineers are needed to determine whether these mechanical incinerators can uniformly meet higher design standards. If such studies prove what presently available data indicate, considerable savings in the cost of incinerators and related structures may result since it will be possible to reduce the size of the plants.

Another type of mechanical incinerator employs a horizontal rotary kiln like that installed at Atlanta (Fig. 3) and Los Angeles. Refuse is shredded into particles not larger than 1 in. before it is fed into the furnace, to secure mobility and to complete combustion of the material as it tumbles through the slowly rotating kiln. Not enough of these units have been installed to determine their effectiveness under the many conditions prevailing in municipal incinerator plants.

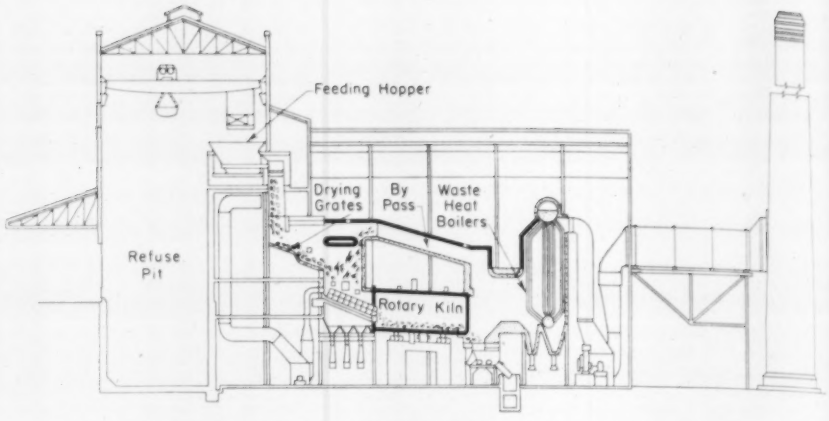


FIG. 3. TWO-UNIT ROTARY-KILN INCINERATOR, designed by Roberts & Co. for Atlanta, Ga., burns 390 tons per day. Waste-heat boilers produce about 1.5 lb of steam per pound of refuse burned. Sale of steam produces revenue of $1.13 per ton of refuse burned. H. J. Cetes is Chief of Atlanta's Sanitary Department.

Labor Savings Realized

Labor savings from the use of mechanical stoking apparatus have already been shown in Detroit, where it is claimed that only 47 percent of the stoking-labor expenditure necessary in the older manually stoked units is required for mechanical stoking. Specifically, stoking labor requirements are 0.272 man-hours per ton of refuse as against 0.576 man-hours in manually stoked plants.

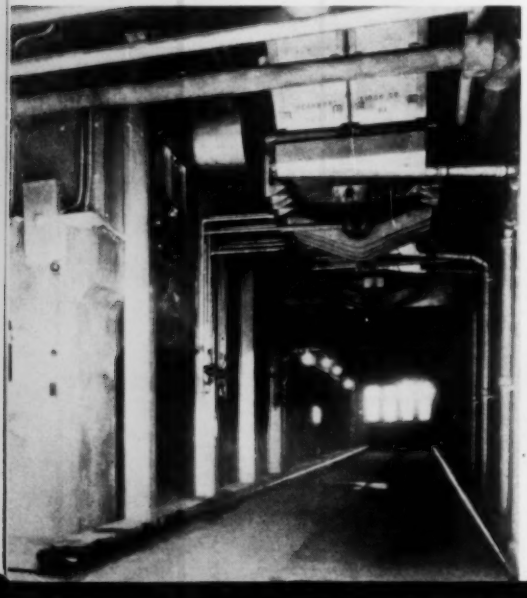
At the smaller plant in Tonawanda, N.Y., only one man is required on the stoking floor, instead of the two needed with the older type of unit. This one man stokes part of the time to supplement the action of the mechanical stoking arms when necessary. He also operates the forced-draft fan and control equipment, and dumps ashes. Similar savings in labor costs have been observed at a number of other plants using mechanical incinerators.

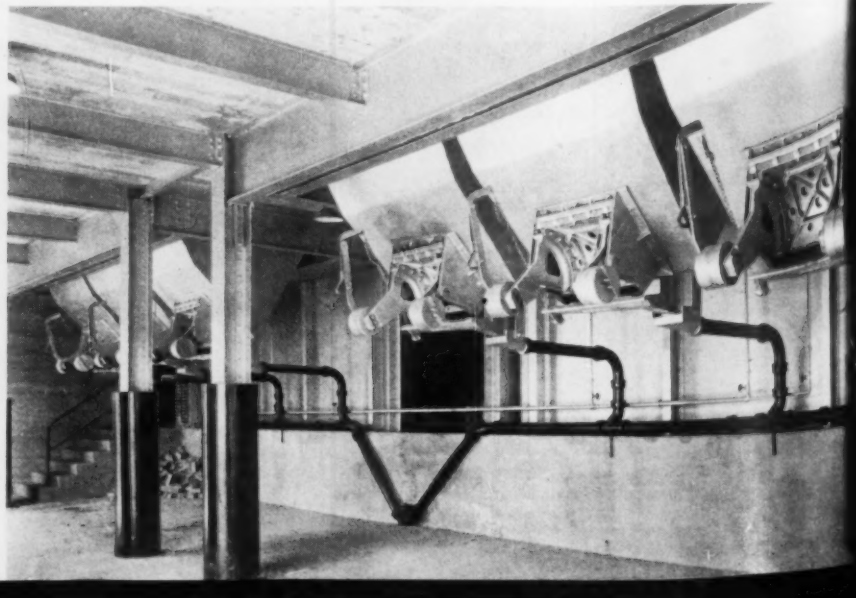
The savings in labor and in decreased size of plant make mechanical units worthy of consideration for incinerators with capacities above 75 tons of refuse per 24 hours. Below this capacity the savings are not as marked since one man is always required—to supervise and at times to assist the mechanical stokers in spreading the heterogeneous material delivered to the incinerator. Cell-type units employing rectangular incinerators with manual stoking from the side or from the end adjacent to the burning grates are still serving well and continue to be specified for new plants, particularly where capacities are less than 75 tons per 24 hours.

Determining Lowest Cost to Municipality

An evaluation of alternative bids providing for manual and mechanical stoking of incinerators must be undertaken to determine the lowest cost to the municipality over a stated period, such as 20 years. Power costs may play an important part in over-all operating costs. Since less labor is expected to be employed with large mechanical incinerators, the designing engineer should rely on his experience and judgment and that of engineers and operators of plants of various types to specify the amount of labor which should be charged to the plant. Statements of contractors as to labor requirements, and evaluation of capitalized costs on the basis of these statements, may prove to be incorrect after the plant goes into normal operation. Bidders should be

IN MODERN PLANTS ashes move by gravity from grates to trucks. Ash tunnel in three-story incinerator at Rochester, N.Y. (below left), has overhead ash gates which, like other plant equipment, are mechanically operated. Ash tunnel in incinerator at Roanoke, Va. (below right), is equipped with hoppers for quenching hot ashes with water before discharge into trucks.





required to guarantee their statements and back them up with an acceptance test, at rated capacity and under normal operating conditions.

Ash Handling Mechanized

Modern incinerator plants require economical means for handling ashes and other residue from the incinerator. In too many plants, stoking personnel clean their fires by drawing refuse from the furnace onto the floor or into carts and quenching it with a stream of water, thereby producing odorous vapors. Adequate dumping grates with ash hoppers and quenching facilities under the furnace will minimize odor nuisance and other operating difficulties.

Most modern incinerators with capacities above 75 tons per 24 hours have been designed as three-story structures to provide for the gravity handling of ashes. The top floor accommodates the refuse handling and charging facilities. The middle floor is reserved for stoking operations, grate dumping and various equipment such as blowers, motors, and electrical equipment. In the ceiling of the bottom floor are placed the ash hoppers, quenching facilities, and ash-loading gates, while the floor itself is reserved for the ash trucks or carts into which the quenched residue is to be dumped.

For smaller plants, below 75 tons per 24-hour capacity, in which the addition of a basement floor would not be justified from the economic standpoint, it is possible to use ash tunnels or ash conveyors submerged in a trough of water. These conveyors may be designed to deliver the quenched residue to an elevated receiving hopper above street level so that ash trucks can be loaded by gravity. Resourceful designing engineers may be relied upon to devise other means of handling and quenching ashes, thus utilizing the advantages of the three-story principle without resorting to the expense of constructing a complete basement under the incinerators of smaller plants.

Removal of ashes from the furnace is not the only problem involved in handling incinerator residue. Plants must be designed to permit easy removal of fly-ash and heavier ashes from combustion chambers with regularity and with minimum delay to plant operation. A three-story plant can be designed to provide for the delivery of these secondary ashes from the combustion chamber to the ash room under the furnaces. Fixed or portable vacuum systems have been used in some plants for the removal of secondary residue from preheaters, combustion and expansion-chambers, and flues. Regardless of whether manual or mechanical methods are utilized for the removal of secondary ashes, the provision of adequate facilities for such removal warrants careful study.

Land Fills for Ash Disposal

An efficient incinerator will reduce combustible refuse to 15 percent or less of its original volume, but there will always be ashes for final disposal. Often this is accomplished by dumping near the incinerator and too often the site reverts to an unsightly and unsanitary dump for incinerator residue and other non-combustible refuse which arrived at the plant and could not be charged into the incinerator.

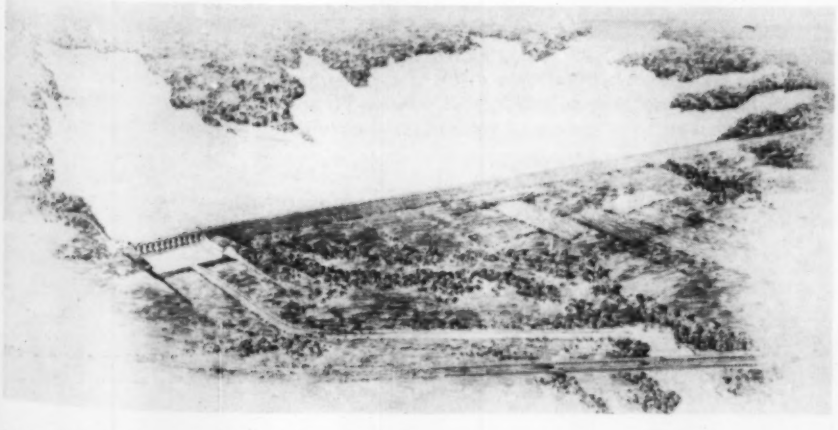
All non-combustible refuse from a municipality requires intelligent handling and a sanitary method of disposal. The obvious answer to these disposal problems is a small sanitary land fill. Incinerators may be placed at various strategic points in a municipality to reduce hauling costs, with sanitary land fills located on the nearest available waste land.

Waste Heat Can Be Recovered

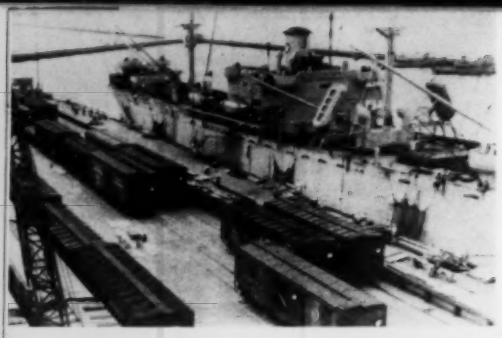
Many cities have installed waste-heat boilers in tandem with their incinerators and following the combustion chambers. The additional cost of the boiler plant may be justified if a sufficient number of users of steam are located nearby. Reports from Atlanta indicate that through the sale of steam a net profit of 21 cents per ton of refuse is realized over the cost of operating the incinerator plant. During the first nine months of 1948 an average of 390 tons of refuse was burned per day—fed to the incinerators on a 24-hour schedule to maintain steam production at a nearly constant rate. The steam was sold to a local private power company, bringing in a revenue of $1.13 per ton of refuse destroyed.

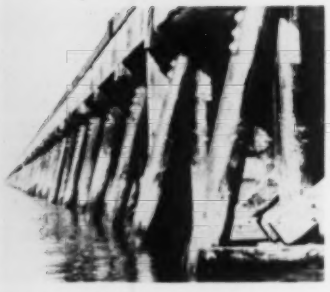
To summarize, municipalities have the choice of several methods for the disposal of mixed refuse. Various factors have ruled out most of these methods in a large number of cities, leaving incineration as the only alternative. Although the construction and operating costs of incinerators are high, savings in labor can be realized by the adoption of mechanical equipment for refuse handling, incinerator stoking and disposal of ashes. Some cities have reduced net operating costs by the recovery of waste heat in boilers located at the incinerator plant. Extensive engineering studies should be undertaken by designing engineers to secure low costs of original construction and the greatest possible economy in operation and maintenance.

Contract Awarded for 9,540-Ft-Long Lavon Dam near Dallas, Tex.



CONTRACT RECENTLY AWARDED by Galveston District, Corps of Engineers, provides for excavation of spillway and completion of embankment for Lavon Dam on East Fork of Trinity River, Texas. Low bid of $2,093,770, about $34,000 under next lowest bid, won contract for J. W. Moorman & Son Co. of Muskogee, Okla. Lavon Dam is one of four flood control and water conservation projects under construction in Trinity River Basin by Corps of Engineers, other three dams being Garza–Little Elm, Benbrook and Grapevine. With height of 69 ft above stream, Lavon Dam will impound reservoir having storage capacity of 423,400 acre-ft. Construction of project was initiated in January 1948 and is scheduled for completion in June 1951.





GOOD MODERN PRACTICE in pier design and construction characterizes U.S. Naval Ammunition Piers at Leonardo, N.J. In top view, ship loads ammunition at deep-water pier which forms part of nearly three-mile length of piers and approaches. Substructure, seen immediately above, contains more than 37,000 creosoted piles from 40 to 99 ft long, about 5 million fbm of creosoted timber in caps and bracing, and 450,000 fbm of salt-treated timber for under-deck fire walls.

Good Design and Chemical Treatment Give Long Life to Wood Waterfront Structures

RALPH H. MANN, M. ASCE

Field Engineer, Service Bureau, American Wood Preservers' Association, New York, N. Y.

WHAT FACTORS contribute most to shorten the useful life of piles, piers, or other timber waterfront structures? Decay, marine borers, storms, and fire, Mr. Mann answers. Proper choice of timber and its pressure treatment will prevent or retard the destructive action of the first two of these factors. A well designed sea wall stands up well against wave action. As for the fourth, the likelihood of serious fire losses in piers can be greatly decreased by incorporating fire bulkheads below the deck, by using fire-retarding salt-treated timber, and by installing sprinkler systems. Recent statistics of the American Wood Preservers' Association and the U.S. Forest Service indicate that during 1947 more than four thousand million fbm was impregnated with chemicals to prevent loss by decay, termites, marine borers, or fire. The same sources estimate that chemical preservation of wood products is saving the nation every day 11,500,000 fbm of timber otherwise doomed. This article is based on the paper presented by Mr. Mann as part of a symposium on structural timber before the Structural Division at the Jacksonville meeting.

UNTREATED WOOD and pressure-treated wood as used in waterfront structures are two completely distinct materials. In fact the difference between these two materials is as great as that between ordinary structural steel and hard, fast-cutting tool steel or stainless steel.

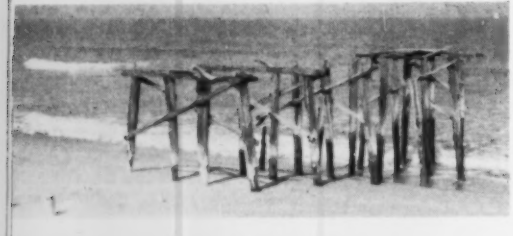
In evaluating the economics of any engineering structure the primary consideration is its useful service life, conservatively estimated. The factors which directly affect the life of a timber waterfront structure are decay, marine borers, storms and fire. In a few instances insects such as termites and wharf borers (nacerda) may be of importance but much less so than either of the other two factors. The subjects of decay, marine borer and insect attack are well treated in the Society's Manual of Engineering Practice No. 17, Timber Piles and Construction Timbers. A quotation from this manual is of special interest in this discussion:

"In general, structures in salt water should be considered subject to attack by marine borers. Even where there is no previous record of destructive attack, the widespread attack in New England, first noted in 1933, shows that changing conditions may bring attack. Since the water conditions which govern attack are unknown, a prediction as to the future is uncertain, and conservative practice normally justifies treatment."

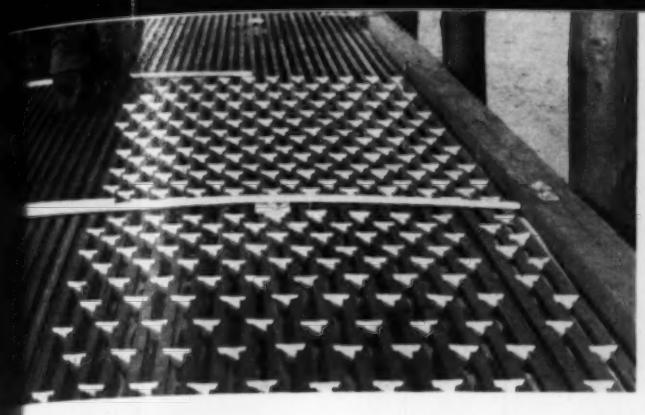
Treatment Prolongs Service Life

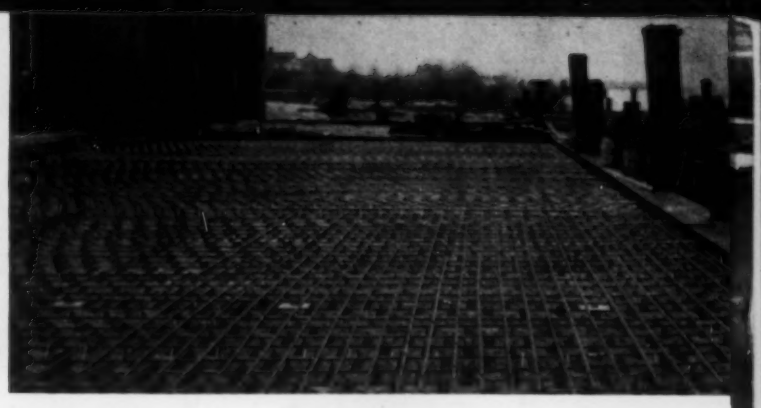
The economic service life of wharf structures in the United States is estimated at from 15 to 50 years, and all timber elements of such structures should be treated with standard wood preservatives by modern pressure processes unless such elements are completely immersed in fresh water or in water free from the threat of marine borer activity.

The economic utilization of long-lived pressure treated piles and tim-



EXISTING STRUCTURES DEMONSTRATE long life of creosoted piling. Flagler Beach (Fla.) Municipal Pier (below, left), now over 21 years old, was built of Southern yellow pine piles treated by full-cell process with 20 lb of creosote per cu ft. Caps, stringers and braces were treated with net retention of 12 lb per cu ft. Contrast remains of untreated pile pier (left) located 2.3 miles north of Flagler Beach, which collapsed in calm sea six months after construction as result of marine borer attack. Fishing pier at Asbury Park, N.J. (below, right), was built in 1885–1888. When destroyed by tidal wave in 1944, creosoted Southern pine piling was still in good condition although it had been in service 56 years or more.





LIGHT WEIGHT, STIFFNESS and good wearing surface are among advantages of composite-type pier deck, which consists of solid laminated creosoted timber slab base covered by, and rigidly interlocked with, concrete mat. Plank is laid on edge with alternate planks arranged to provide longitudinal grooves 2 in. deep for seating shear developers (see cross section, Fig. 1, at right). Shear developers, which are triangular pieces of metal about $3^1/_2$ in. high, are driven (above left) to develop horizontal shear. Uplift spikes driven in high laminations on approximately 2-ft centers, prevent curling of concrete away from planks. When deck reinforcement is placed (above, right), concrete is poured directly on planks to thickness of $5^1/_2$ in. above high laminations. Decks pictured are on wharfs of Coast Guard Unit at Shinnecock Bay, Long Island, N.Y.

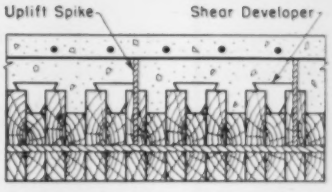


FIG. 1

bers is predicated upon three basic factors: (1) the species of wood and its grade and strength classification if sawn, or its size and physical characteristics if it is pile timber; (2) the preservative used; and (3) the final net retention of preservative injected in pounds per cubic feet of wood.

The choice of species is critical because of the factors of strength and treatability of the timber. The principal American species from which structural lumber and piles are obtained are Southern yellow pine and Douglas fir, which combine strength and treatability and comprise the greatest available stands of structural timber in the United States today. They also have equivalent stress ratings, grade for grade.

Determining "Conditions of Exposure"

The choice of preservative and amounts injected are important because of the various "conditions of exposure." The "condition of exposure" of a waterfront structure is revealed by the answers to the following questions: (1) Are the wood piles and timbers to be placed in tidewater or fresh water? (2) If timber foundation piles or timber footings are to be placed in the ground, will the pile cutoff elevations or the tops of the footings be above the permanent groundwater table? (3) What is the geographic location and local case history, with regard to decay, of the air-exposed or above-water portions of the structure?

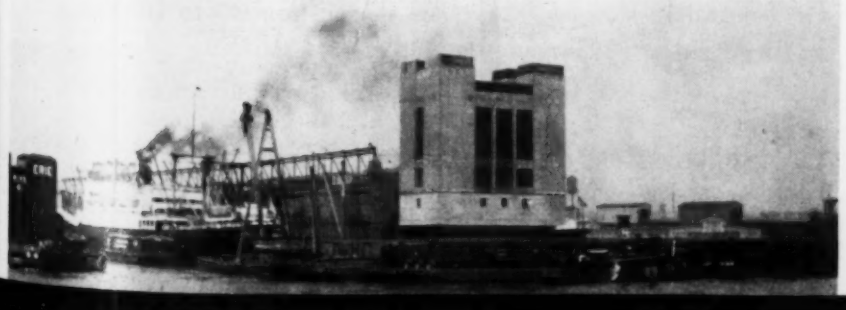
IRON CLAMPS hold tight pairs of 6×12-in. timbers which form bent cap (right) while they are drilled and bolted to mortised pile tops for pier built by U.S. Lighthouse Service at St. George, Staten Island, N.Y. All-creosoted pile and timber construction was used in pier (also shown above).

An excellent guide to the engineer in the selection of species, preservative, absorption and method of impregnation is the "Federal Specification for Wood-Preservative; Recommended Treating Practice," No. TT-W-571b. This specification follows the standards of the American Wood-Preservers' Association throughout.

The importance of adequate design of timber waterfront structures is shown by the way such structures withstood or failed to withstand the two disastrous hurricanes which swept the North Atlantic Seaboard in 1938 and 1944. Careful inspections following each of these disasters revealed that structures which had been adequately designed by their engineer-builders were intact after the passage of the storm. Many other structures built without adequate design considerations were generally found to be a mass of splinters. (See photographs and Fig. 2.)

Another factor which affects the life of a timber waterfront structure is fire. An outstanding example of a

CREOSOTED BLACK-GUM DECK stands up well under heavy truck traffic on Pier 9 at Jersey City, N.J. (below). Traffic lane on lower deck (right), formed by planks laid on edge, has been in service since 1933. Good service record of same type of surface installed on upper deck of this pier in 1929 was reason for its use here. In storage areas of pier, salt-treated black gum plank was used.



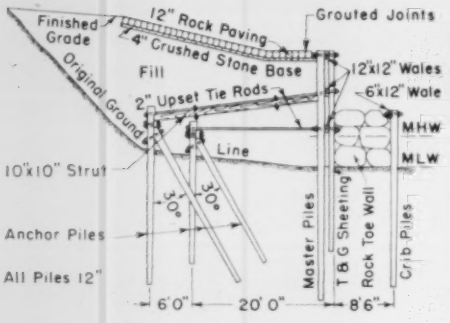


FIG 2

HURRICANE AND TIDAL WAVE of September 14, 1944, caused only minor damage to creosoted timber sheetpile bulkhead on Atlantic Ocean at Long Branch, N.J. Newly built bulkhead (far left, top) with crest 16 ft above sand line, is faced with riprap held in place by untreated timber piles. Following hurricane, bulkhead is undamaged (left). Cross section, Fig. 2 (far left) shows design, by Clayton King, Assoc. M. ASCE. Before bulkhead was built, land had been eroded to cross section shown. After placement of bulkhead ties and struts, area was filled to level seen in photographs.

modern fire resistive pier on tidewater, built wholly of treated wood, is Pier No. 8 of the Chesapeake & Ohio Railroad Co. at Newport News, Va. On December 17, 1944, the old pier burned; 75 days later the first ship was laden at the new pier with urgently needed combat materials en route to the battlefront.

Modern Pier Designed to Resist Fire

Pier No. 8 is 800 ft long and 213 ft wide. There are four tracks on the deck, two depressed tracks set along the center line and a single track running along the 20-ft uncovered apron at the pier edge on each side. A one-story timber framed superstructure 173 ft wide runs the full length of the pier with the exception of the 17-ft end apron. The substructure is entirely of wood, founded on 3,905 creosoted piles from 50 to 120 ft long, of Southern yellow pine and Douglas fir. The piles were treated with 20 lb and 14 lb of creosote per cu ft respectively. Pile bents were on 8-ft centers. Greenheart piles were driven for fenders and for the four bents where under-deck fire bulkheads, spaced 200 ft apart, were installed.

The best modern methods for making Pier 8 fire-resistive were incorporated by the engineers of the railway. These methods consist of: (1) Installation of fire bulkheads extending from the under side of the deck to slightly below mean low water; (2) utilization of fire retardant salt-treated timber and lumber above the pile cutoff—a method greatly accelerated by the war; and (3) the installation of sprinkler systems both under the deck and in the superstructure.

The under-deck fire walls consist of a solid 2-in. wall of tongue-and-grooved green-heart lumber attached to green-heart bent piles by 4×12-in. green-heart studs bolted to the piles; 70,000 fbm of such lumber was used. A total of 358,000 fbm of cresoted Southern pine bent braces (4×8 in. and 3×10 in.) and Wakefield type sheet piles, treated with 18 lb of creosote per cu ft, were installed in the substructure.

All the other timber in the entire pier was given a fire-retardant treatment, all in accordance with Type 2 and Type 4 of the federal specifications for fire-retardant timber and lumber. From 4 to 6 lb of fire-retarding plus decay-resisting chemicals per cu ft of wood were injected by standard pressure processes. Such treatments are in conformance with the Chesapeake and Ohio Railway Company's construction-maintenance practice.

Members of the substructure so treated include 12×12-in. caps, 6×12-in. deck stringers, 8×16-in. railway track stringers, and the 4-in. decking.

Members of the superstructure given the fire-retardant treatment included 50 prefabricated four-unit roof trusses spaced on 16-ft centers; 12×12-in. column supports for the trusses; the 3×12-in. and 4×12-in. purlins; the $2^5/_8$-in. tongue-and-groove roof sheathing; and the 2×6-in. shiplap tongue-and-groove siding to which the corrugated, galvanized siding was attached. A total of 3,100,000 fbm of timber was given fire retardant treatment.

Waterfront structures of wood for use in tidewater or on fresh-water inland waterways include: (1) docks, piers, and wharves; (2) bulkheads of the sheetpile, crib or relieving-platform types; (3) shore and beach protective structures such as jetties, groins, spur dikes, and revetment works; (4) ferry racks; (5) approach trestles; (6) foundation piles.

In the following discussion of waterfront structures, some representative installations will be described. Taking piers first, one of the most representative structures, Pier No. 8 at Newport News, Va., has already been described.

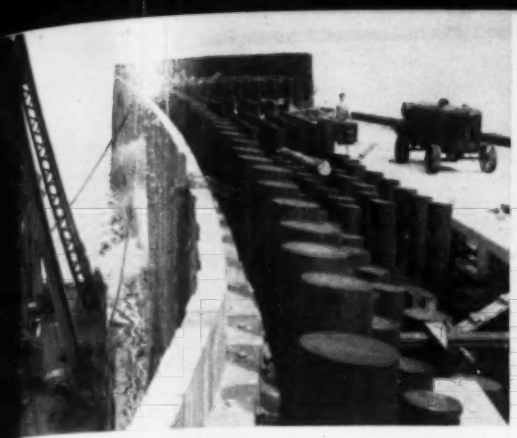
Pier Installations in New York and Philadelphia

A large number of important pier installations are to be found in the Port of New York where for many decades the following basic design procedures have been followed:

1. Substructures are on timber piles with timber caps and braces. The deck systems are of timber plank carried on timber stringers or of reinforced concrete slabs carried on bent caps.
2. Pile bents are on 10-ft centers, with bent piles spaced about 5 ft apart.
3. Live load for deck area is 500 lb per sq ft.
4. Design loads for piles, which range from 40 to 110 ft long, is 15 tons.

As in many other ports, New York piers generally extend into the water at 90 deg to the bulkhead line, providing berths for ships on two sides.

BULKHEAD PROTECTS BUILDINGS at Long Beach, Long Island, N.Y., from damage suffered by unprotected buildings in hurricane of September 21, 1938.



TOP OF FERRY RACK (above, left) and view from inside slip (above, right) show some of 1,300 pressure creosoted piles used in construction of two ferry slips recently completed at Staten Island Municipal Ferry Terminal in New York harbor. Besides buttress clusters, each rack contains three rows of piles driven on 3-ft centers, piles in center row being staggered to fall midway between those in adjacent rows. Piles in each row are connected by horizontal wales. Pile lengths range from 55 to 80 ft. Southern yellow pine and Douglas fir piles were used, pressure treated with 16 and 12 lb of creosote per cu ft respectively. Treatment was specified to protect under-water sections from marine borers and above-water sections from weathering and rot.

In the Port of Philadelphia, the "Philadelphia-type" pier was evolved. It differs from the New York standard in that the substructure piles are cut off and capped at approximately mean low water and decked over with 4-in. timber plank. A gravity retaining wall of masonry surrounds the three water sides of the pier, and an earth or sand fill is placed to pier-deck grade within the retaining wall.

An interesting case of failure of a Philadelphia-type pier occurred in that city about two years ago when pavement laid on the central filled portion of a pier collapsed under a loaded truck. Subsequent investigation disclosed that the untreated platform deck planking, the top face of which was 16 to 18 in. above mean low water, had decayed, allowing the earth fill to wash out. Because of the tidal variation of about 5 ft, indicating that theoretically the wood was wet at least 80 percent of the time, the decay of the wood at first seemed inexplicable. However, examination disclosed that the bents were topped by pairs of 6×12-in. clamp timbers bolted to the tenoned or notched pile heads, and that the gaps between bents at the pier edges were enclosed by other 6×12-in. filler pieces, so that the entire assembly formed an inverted box 12 in. deep between each bent. Rising tides trapped air in the box under a head of about 5 ft at high tide, and this air caused the under side of the decking to decay. The deck was replaced by pressure-creosoted planking.

Although current pier construction practice often favors the use of 12×12-in. or 14×14-in. cap timbers, drift bolted to each bearing pile, many engineers still prefer the use of pairs of 6×12-in. clamp timbers set in notches on each side of the bent piles and through-bolted to the resulting tenon.

Engineers of both ports feel that the superior resilience of wood piles under the impact of ships has long proved the wisdom of their choice of wood for pier substructures. The resilient timber pile substructure can take the shocks without damage to impinging ships.

Probably because of the low salinity of the Delaware River at Philadelphia and the former high degree of pollution of the inner harbor at New York, the menace of attacks by marine borers was discounted by both ports until recent years, when evidence of attack was noted in New York. At this port untreated timber piles were used until about ten years ago, when it became the standard practice of the Dock Department, now the Department of Marine and Aviation, to specify only pressure creosoted caps, braces, and other elements for all new piers.

Three Miles of Piers at Leonardo, N. J.

For magnitude and speed of erection under the stress of war, three miles of piers and approaches of the joint Army and Navy's ammunition piers at Leonardo, N.J., about 13 miles south of the Narrows, are notable. (See photographs.) The structures include a 2,370×64-ft barge pier with alongside water depths of 12 to 15 ft.; two deep-water piers 136 ft wide and respectively 1,287 and 693 ft along; and over two linear miles of approach trestle structures 34 ft and 46 ft wide.

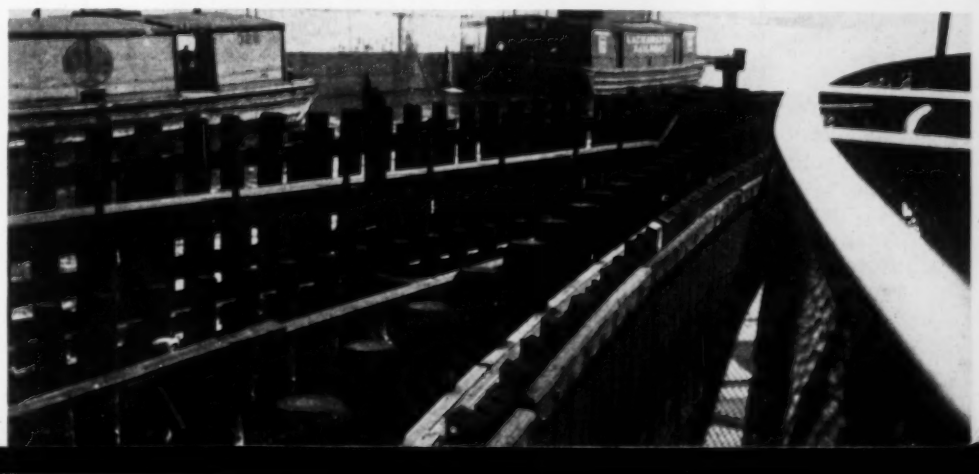
The seaward end of the deep-water piers is $2^1/_8$ miles offshore. More than 20 acres of pier and approach area are included in the facility. The entire substructure is composed of pressure creosoted piles, with creosoted 14×14-in. cap timbers and braces. The deck is of concrete 20 in. thick. Two lines of railway trackage serve the piers. Track sections are designed for Coopers E-60 loading, and vehicular roadways for the standard H-20 loading.

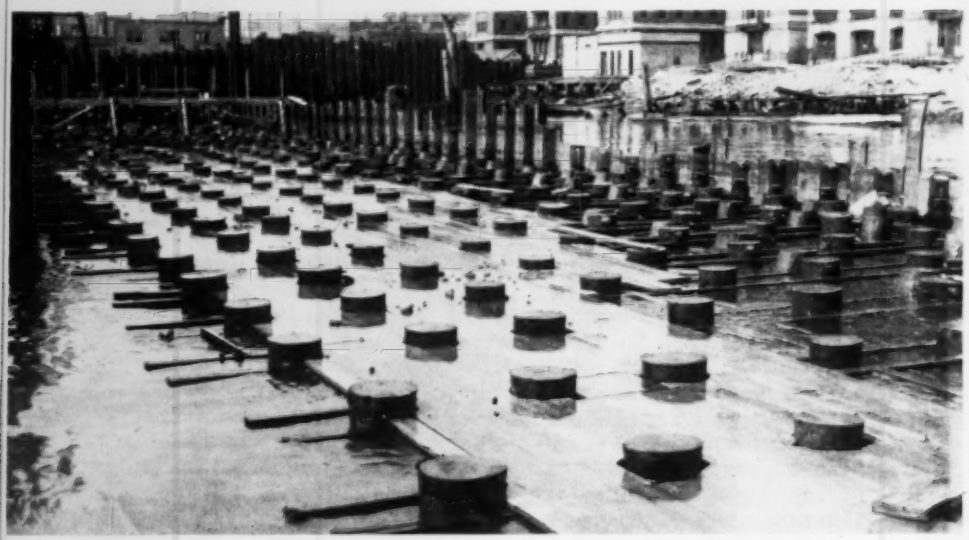
Below-deck fire bulkheads of salt-treated timber extend from the underside of the deck to 2 ft below mean low water. Fire bulkheads about 160 ft apart throughout piers and approaches and an under-deck sprinkling system were also installed. The resistance of this structure to destruction by fire is shown by the fact that when the ammunition ship U.S.S. *Solar* was destroyed by an explosion in April 1946, the pier fire which followed was not serious and was quickly extinguished.

Pier Decks Designed to Wear Well

Dead loads on pier decks are of great importance in many instances, especially at waterfront sites where the deep underlying soils into which the piles are driven have a low bear-

TWENTY-FIVE YEARS OF SERVICE leaves creosoted pile racks at Exchange Place Ferry Terminal, Jersey City, N.J., in good condition. About 80 per cent of original piles are still in service in Pennsylvania Railroad passenger terminal.





RELIEVING PLATFORM which supports New York's East River Drive rests on 72,000 piles driven offshore in water from 20 to 30 ft deep. Drive, completed in 1942, carries six-lane, two-way high-speed traffic for distance of 7 miles, of which 4.3 miles is supported on relieving platform bulkheads. In upper photograph vertical and batter piles have been driven for new section of drive and bents are being stay-lathed. Wood form, in place in lower photograph, carries reinforced concrete slab. Design (see Fig. 3, below) is based on assumption that creosoted piles used will outlast other materials in structure.

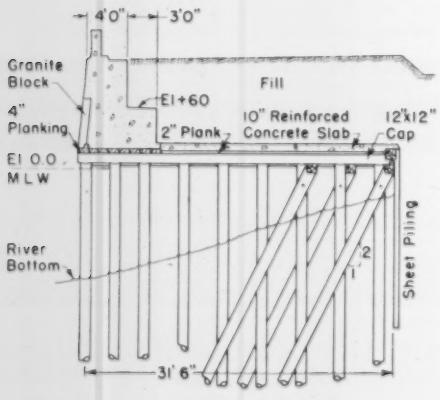


FIG. 3

ing power. In such cases the use of a timber deck system is an excellent solution to the designer's problem.

Mechanical wear of pier-deck planking is another problem which often troubles the designer. This problem can often be solved by specifying decking of treated black gum, one of America's best timber species in its superior resistance to mechanical wear. Untreated, it decays fairly rapidly, but it is easy to treat.

On the upper deck of Pier 9, Jersey City, owned by the Erie Railroad Co., creosoted and salt-treated black gum plank has been in service since 1929. The salt-treated plank was installed in cargo storage areas, and the creosoted plank in vehicular areas. The planks are 4×8 in., laid flat, and securely fastened to the floor system by through bolts and lag screws. Because of the tendency of this species to twist when laid flat, especially if the planks are less than 3 in. thick, plank should be securely fastened to the supporting elements of the deck.

In 1933 the engineers of the Erie Railroad were so pleased with the excellent service rendered by the treated upper deck planking on Pier 9 that the same material was installed on the lower deck truckways on both sides of the pier. (See photograph.) The planks are nominally 4×8 in., laid on edge (laminated longitudinally), spiked together by $^{3}/_{8}$×10-in. wrought-iron boat spikes and treated with 8 lb of creosote per cu ft of wood. When last inspected this decking was in excellent condition.

Composite Decks Give Various Advantages

The timber-concrete composite deck is a structural assembly particularly adapted to piers and bridges as it is stiff, strong and light. It consists of a solid laminated timber base with a concrete surface superimposed. (See Fig. 1 and photographs.) The deck is laid upon and anchored to the pile bents without the use of stringers. For a 12-in. over-all deck slab thickness, it weighs about 100 lb per sq ft. Such a deck is capable of carrying live loads of 600 lb per sq ft on 16-ft bent spans. The two elements are interlocked at the contact plane by an artificial shear device which converts the assembly into a unit with an effective depth equivalent to the over-all thickness of the two materials.

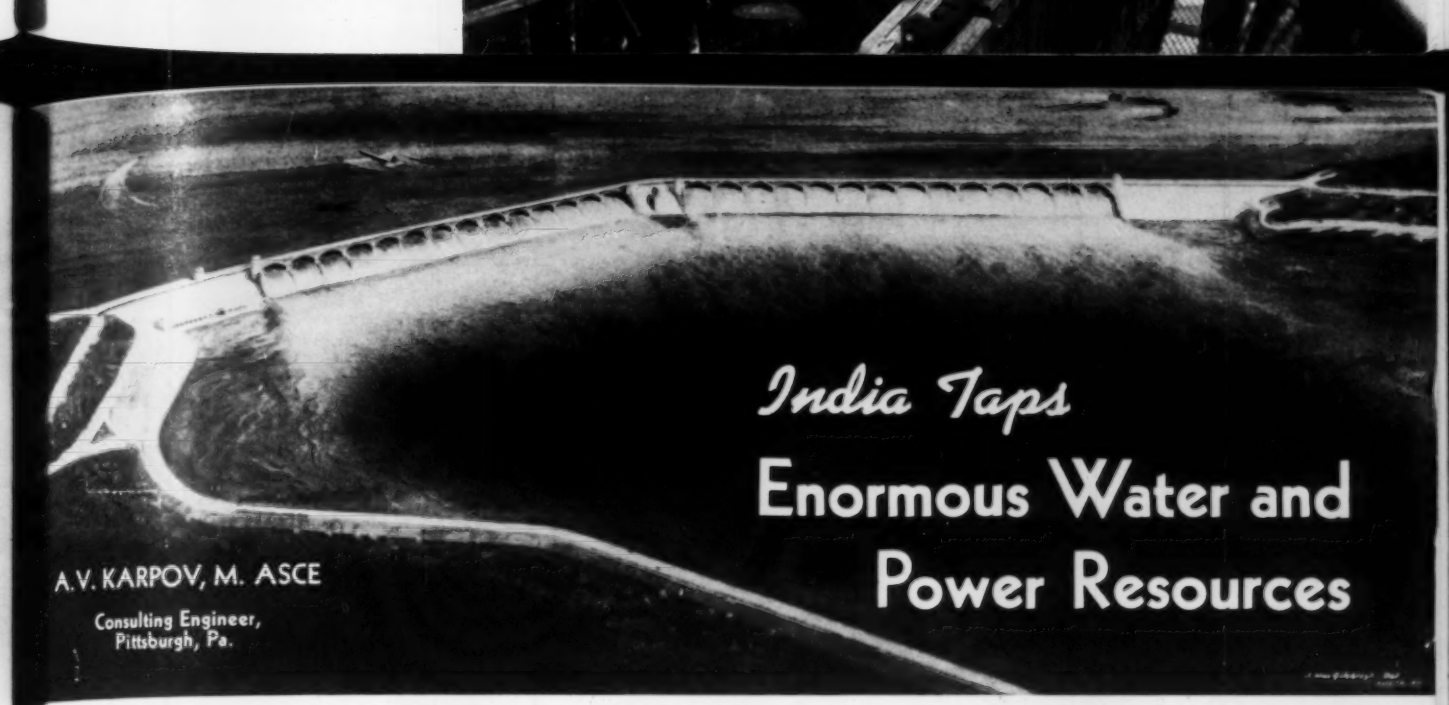
A concrete mat, besides forming an excellent wearing surface which protects the timber from mechanical wear, distributes concentrated loads over wide areas, and by virtue of the shear connection becomes an effective part of the supporting medium. The use of timber gives strength in both tension and compression and has the further advantage of light weight. Combining the two materials in composite construction utilizes each to advantage and results in a product suitable for many modern structures. The composite deck has been tested in actual service under a variety of climatic and load conditions during the last 15 years and has proved highly satisfactory.

Other Types of Waterfront Structures

Another important waterfront facility which utilizes creosoted timber piles to advantage is the relieving platform bulkhead. In 1942 the City of New York completed the East River Drive, one of the city's newest permanent waterfront parkways, about 7 miles long. Along 4.3 miles of the route, relieving platform bulkheads were built along the shore of the East River to support the highway, utilizing about 72,000 long creosoted piles to carry the substructure. (See Fig. 3 and photos.)

Pressure creosoted piles and timbers also provide the engineer with a

(*Continued on page 80*)



India Taps Enormous Water and Power Resources

A.V. KARPOV, M. ASCE
Consulting Engineer,
Pittsburgh, Pa.

CONSTRUCTION OF RAMAPADASAGAR DAM and power plant on Godavari River, Madras, India, is scheduled to start this year, with completion expected in 12 years at cost of $258 million. Drawing shows proposed 1 1/2-mile-long masonry dam, 428 ft high, requiring 20 million cu yd of excavation and 8 million cu yd of concrete. Reservoir of 15,600,000 acre-ft will irrigate 2,350,000 acres through new canals and 2,100,000 additional acres through existing canals.

FOR CENTURIES irrigation has been a main concern of Asiatic countries. Recurring floods and droughts have vitally affected their economic well-being and the lives of their people. Believing that economic independence and a boost to the living standards of her people can be achieved by developing power and using it rationally, as well as by building works to control and distribute water, India is making a tremendous effort to get these works under construction. Speaking before the Power Division at the Ninety-Sixth Annual Meeting of ASCE, Mr. Karpov drew attention to the large hydroelectric and irrigation works projected in India. He cautioned engineers to make their designs suit local conditions, which are very different from those in the United States, and to utilize fully in the construction of such works both local materials and local labor—limiting the importation of labor-saving machinery.

DEVELOPED COAL RESOURCES of the world are small except in the United States and in Europe. Improvement in standards of living in many countries depends on the development and successful utilization of new power resources. Not in this or the next generation will utilization of nuclear energy reach a stage where atomic fission power plants will be built in other parts of the world. Falling water must be used in the future to a larger extent than in the past.

In Asiatic countries plans are being made, and in some instances work has been started, on multi-purpose developments including irrigation, power, water transportation and water supply. India and China alone have over half of the total irrigated areas of the world. India is endeavoring to irrigate many millions of acres of agricultural land.

TABLE I. ORDER OF IMPORTANCE OF TEN MAJOR RIVERS RISING IN HIMALAYA MOUNTAINS

(From *Earth's Grandest Rivers*, by Ferdinand C. Lane)

In Average Discharge of River	In Population Supported by River
1. Yangtze	1. Yangtze
2. Mekong	2. Hwang Ho
3. Brahmaputra	3. Ganges
4. Indus	4. Mekong
5. Ganges	5. Indus
6. Hwang Ho	6. Brahmaputra
7. Irrawaddy	7. Irrawaddy
8. Salween	8. Amu Darya
9. Syr Darya	9. Tarim
10. Amu Darya	10. Syr Darya

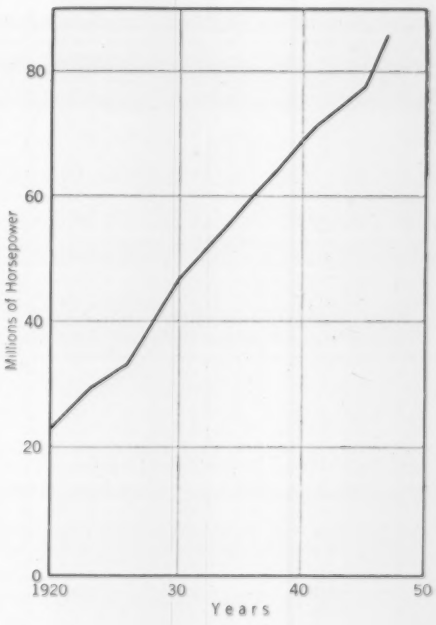
NOTE: First three are among largest ten rivers of world in discharge. Mississippi River rates between the Mekong and the Brahmaputra in discharge.

Himalayas Influence Climate

The Himalaya Mountain system is probably the most important in the world. The climate of Asia, the fertility of the soil, the precipitation and the availability of water for irrigation, power and stream navigation—in short the whole existence of its people—depend on these mountains. They shield India from northern cold and provide it with abundant rain.

Geologically the Himalayas are of recent origin. An interesting phase of their development concerns their relation to the Indian and Arabian Peninsulas. These peninsulas, formed in the Paleozoic era, more than 250 million years ago, were already fully matured in the late Tertiary period, 25 million years ago, when the formation of the Himalayas began. Numberless powerful volcanic eruptions took place with the rising of these mountains, thrusting and crushing the earth's crust against the more stable Indian Peninsula

FIG. 1. CAPACITY of world's water power plants grows over 2 million hp each year, according to U.S. Geological Survey Data. Up to 1949 only 13 percent of power available from low flow of world's rivers has been developed, in Asia but 7 percent.



into a gigantic deformation (Fig. 2). The result of these powerful disturbances can be observed today in the numerous ranges of the Himalayas towering nearly 30,000 ft above the Ganges-Indus alluvial plateau, with mountain valleys ten to fifteen thousand feet in depth between them.

Between the Tibetan Plateau of Asia and the Indian Peninsula the geologic section of the earth's crust is as shown in Fig. 2. From the highest peaks of the Himalayas, among them 29,141-ft Mt. Everest, the parallel ridges thrust up in past geologic ages diminish in height toward the Indian Peninsula until the Ganges Depression is reached. During the past few million years, the depression has filled with alluvium washed down from the mountains. By carrying and depositing this silt, the Indus, Ganges and Brahmaputra River systems have formed 300,000 sq miles of the most fertile lands in the world. This region is the most important economic factor in making possible the present existence of India and Pakistan.

In the gorges of the Himalayas, granitic rocks of great strength permit construction of the highest known dams on reliable foundations. On the alluvium of the Ganges Plain however, even a low dam is difficult to build and maintain, because reliable rock is covered by thousands of feet of soft material. A study of the geologic section in Fig. 2 indicates why on the Kosi River a dam of any desired height is possible while on the Little Gandak and the Ganges Rivers only low dams can be constructed and then with difficulty to be expected from water underpassing the structure. In the rolling hills of the Indian Plateau region, where good rock formations come close to the surface again, dams of the Damodar River developments are not limited in height by foundation conditions but rather by reservoir topography.

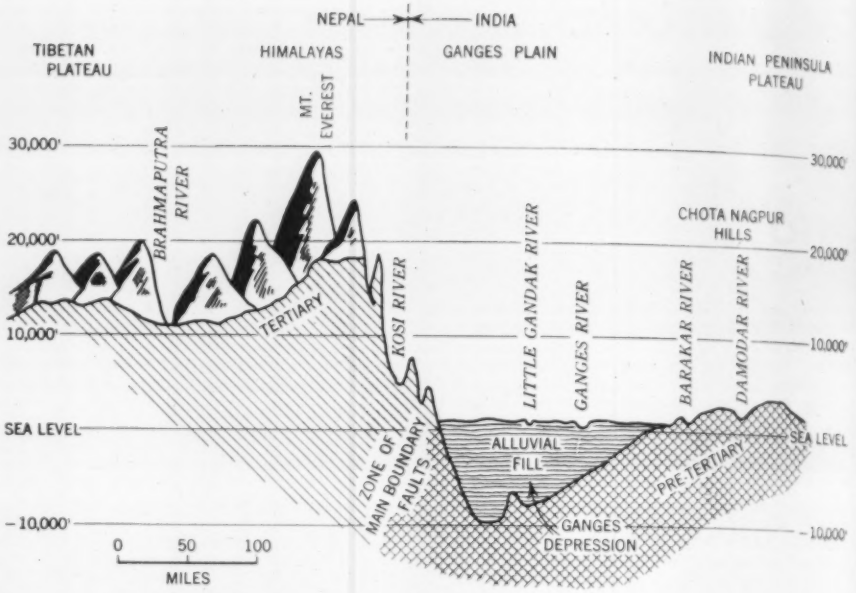


FIG. 2. GEOLOGIC SECTION across Himalayas and Indian Peninsula indicates why high concrete dams are not built on Ganges River.

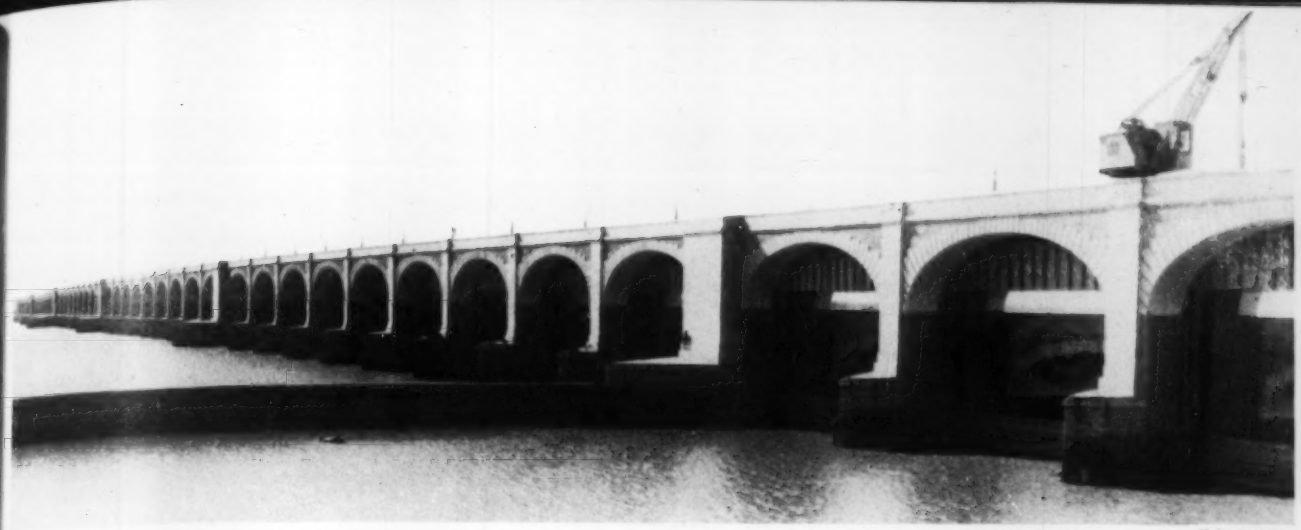
FIG. 3. HIMALAYAS ARE SOURCE of first-magnitude rivers. Many Asiatic rivers drain into inland lakes and depressions.

Population Growth Adjusts Itself to Irrigation Water Available

As compared with other continents a remarkable feature of Asia is that a large area has no drainage to the sea. Including the Caspian Sea, located partly in eastern Europe, about 5 million square miles, or 30 percent of the area of the continent, drains into various land depressions.

From the Himalayas the largest concentration of water on earth from a single source flows in the Hwang-Ho, Yangtze Kiang, Mekong, Salween, Irrawaddy, Brahmaputra, Ganges and Indus Rivers—each one in itself a river of first magnitude. The order of magnitude of the first ten rivers originating in the Himalaya Mountains is shown in Table I. These and other drainage areas of the region are shown in Fig. 3.

The character of the rivers in this region depend on the water sources. In the Indian Peninsula the only water comes from monsoons. In the lower reaches of the Brahmaputra River, in Cherrapunji, a maximum yearly rainfall of 1,000 in. has been recorded, the highest precipitation in the world. Rivers originating in the Himalayas are fed by melting snow and glaciers, and while such a river may have a low flow of but one-hundredth its peak flow, it will not be dry during the dry northeast monsoon season.



Philip Gendreau

LLOYD BARRAGE in Pakistan, across Indus River near Sukkur, stores water for world's largest irrigation project and converts about six million acres of desert into productive land (No. 4 in Fig. 5). Dam completed in 1928 is 190 ft high and contains 800,000 cu yd of concrete.

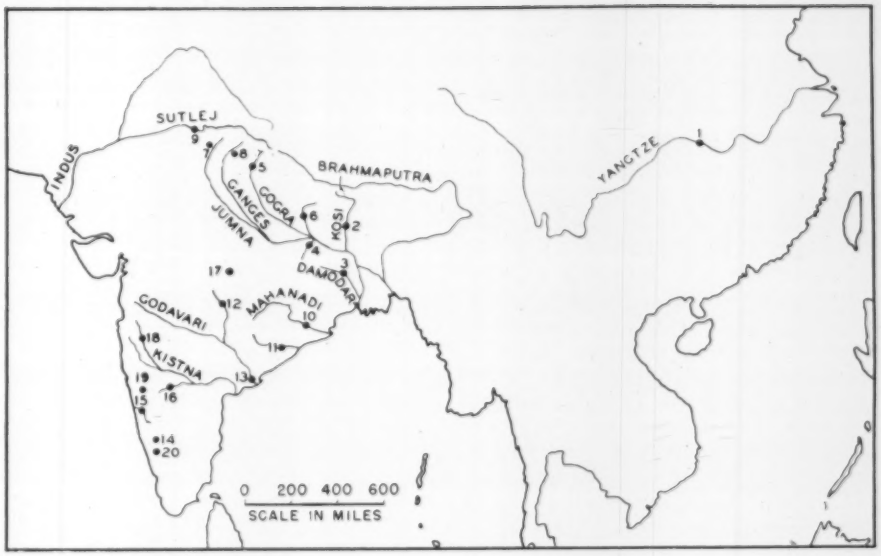


FIG. 4. MAP LOCATES major proposed multi-purpose developments detailed in Table II. When completed, projects will generate 8½ million kw and irrigate 11 million acres of land in India—not including Yangtze Dam in China.

For centuries, even for thousands of years, the population growth in the monsoon countries of Asia adjusted itself to the amount of food that could be raised during an average year. The heaviest populated area of Asia is in the Ganges Valley of India where the population is more dense than in China. Improvement in the lives of hundreds of millions of people there depends on their ability to enlarge irrigated areas, and to provide seasonal and carryover water storage.

Record-Size Multi-Purpose Projects Under Construction

Large works have been inaugurated in India and still larger ones are projected. In areas of high rainfall, water is caught and stored in small earthen reservoirs, or tanks, into which groundwater also is pumped. Large-scale irrigation projects in the western portion of the fertile plain where rainfall from monsoons is small, are supplied from the Himalayas through the Indus and Ganges Rivers. Particularly impressive are the irrigation projects along the lower Indus River. Here the famous Lloyd Barrage Scheme, claimed to be the world's largest, has changed a desert into one of the most productive places in Pakistan.

Major proposed developments in India can be located by examining Fig. 4 and Table II, which show every known proposed project that involves an ultimate power develop-

TABLE II. MAJOR PROPOSED MULTI-PURPOSE DEVELOPMENTS IN INDIA

	River	Drainage Basin	Development	Location	Dam Height Ft	Capacity, Kw	Irrigation Area, Acres	Cost in Millions
1.	Yangtze	Yangtze Kiang	Yangtze Gorge	Ichang, China	820	15,000,000		$3,000
2.	Kosi	Ganges	Chhatra	Nepal & Bihar	850	1,800,000	3,000,000	300
3.	Damodar	Ganges	Damodar Valley	Bengal & Bihar		200,000	1,000,000	165
4.	Rihand	Ganges	Pipri	United Prov.	280	230,000	400,000	90
5.	Gogra	Ganges	Karnali	Un. Prov. & Nepal		300,000		
6.	Gandak	Ganges		Bihar		600,000		
7.	Tonsa & Yamuna	Ganges		United Prov.		210,000		63
8.	Nayar	Ganges	Marora & Byasghat	United Prov.	600	232,000	238,000	75
9.	Sutlej	Indus	Bhakra	East Punjab	560	850,000	1,500,000	210
			Nangal			144,000		66
10.	Mahanadi	Mahanadi	Hirakud	Orissa	150	350,000	800,000	145
			Tikarpara	Orissa		432,000	224,000	
			Naraj	Orissa		107,000		
11.	Machkund	Machkund	Duduma Falls	Orissa & Madras		100,000		27
12.	Wainganga	Godavari	Wainganga	Cent. Prov. & Behar	155	1,000,000	1,000,000	
13.	Godavari	Godavari	Ramapada-sagar	Madras	428	460,000	2,350,000	258
14.	Pykara			Madras		212,000		
15.	Sharavathi		Mahatma Ghandi	Mysore	104	240,000		
16.	Tungabhadra	Kistna		Hyderabad & Madras	160	139,000	900,000	90
17.	Chambal	Ganges	Chambal	Holkar, Mewar, Kotah	200	152,000		
18.	Koyna	Kistna		Bombay	300	400,000	450,000	*30
19.	Kaii Nadi			Bombay		350,000		
20.	Chalakudi			Cochin State		200,000		60

* First Step.

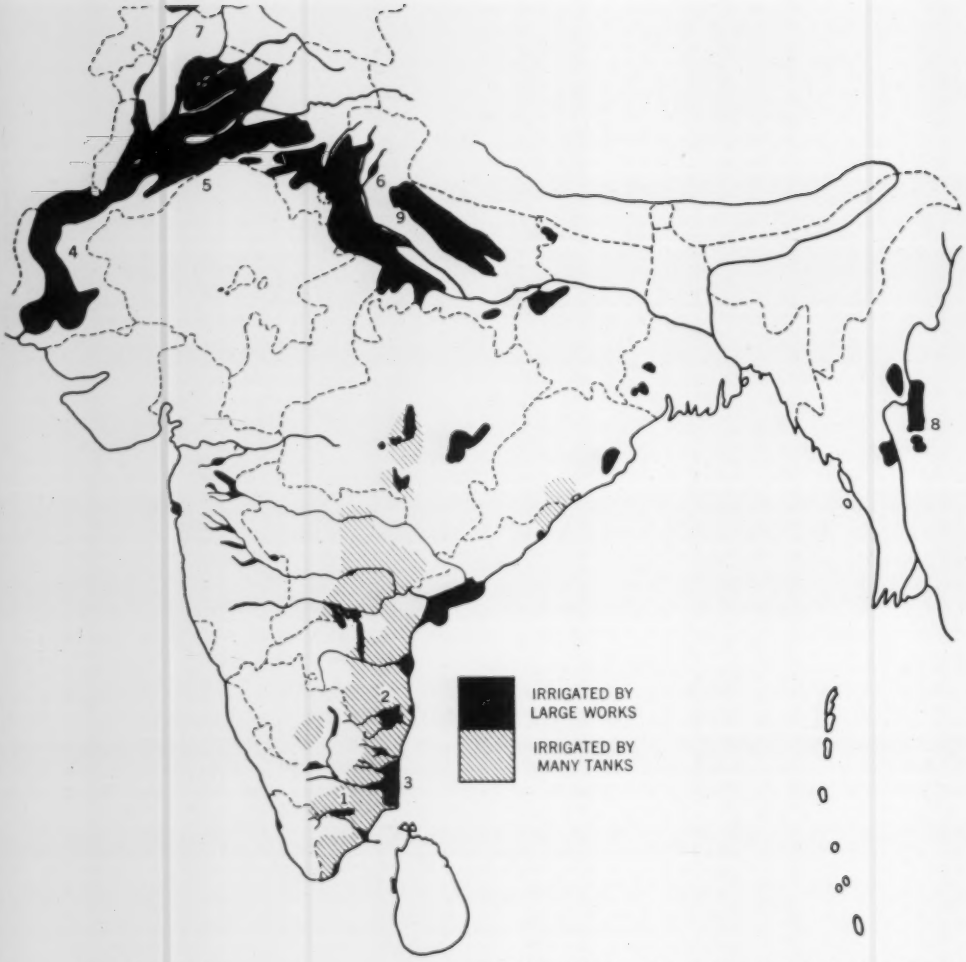

IRRIGATED BY LARGE WORKS
IRRIGATED BY MANY TANKS
1. Periyar System
2. Cheyyar, Poini and Palar System
3. Cauvery Delta System
4. Sind (Lloyd Barrage Scheme)
5. Punjab
6. Ganges-Jumna Systems
7. Vale of Peshawar
8. Dry Belt of Burma
9. The Sarda Scheme

FIG. 5. IN MONSOON AREA of South India, land is irrigated generally from numerous small earthen reservoirs called tanks, which catch rain water and into which groundwater is pumped. Development of lands bordering Ganges and its tributaries and on Indus and Sutlej in Northern India requires large diversion dams and canals. Information after L. Dudley Stamp.

ment of 100,000 kw or over. On the Indus and on the Ganges and its Himalayan tributaries a string of eight developments is proposed having an aggregate capacity of over 4 million kw. Other proposed developments, shown in Fig. 4, will derive their water from monsoons.

In most Asiatic countries a number of factors necessarily influence construction work. Probably the most important are the shortage of skilled labor and the low cost of unskilled labor. Next is the difficulty, cost, and in many instances impossibility of obtaining any manufactured materials locally. Such simple items as nails, bolts and nuts, which in the United States can be obtained in any locality, must either be imported from abroad or in the best case obtained from some manufacturing plant in India. Structural-steel shapes and more complicated pieces of machinery like concrete mixers, bulldozers, and trucks must be imported.

The cost of imported machinery and the absence of skilled men to operate it must be weighed against the availability of a vast reservoir of cheap unskilled labor. These considerations make the situation very different from that in the United States and tip the economic balance against labor-saving devices and toward the employment of unskilled labor wherever possible.

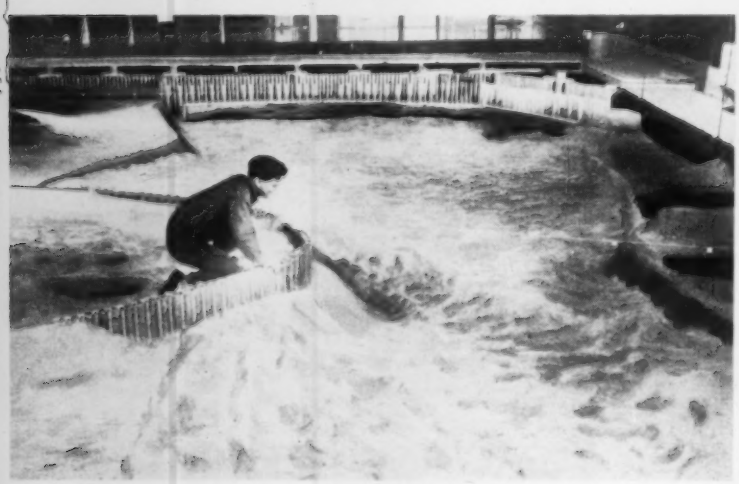
Utilize Large Supply of Manual Labor

There are instances in which the use of manual labor is not only an economical but a social necessity. It may be to the distinct advantage of the country to direct the over-supply of labor to useful and gainful work. The men thus trained will continue to work on other projects, thus improving the condition of the country.

It is impossible to lay down rules to cover all projects. Each project must be studied individually. Design rules must be laid down and followed to make each project as successful as possible under the particular conditions that must be met. A few

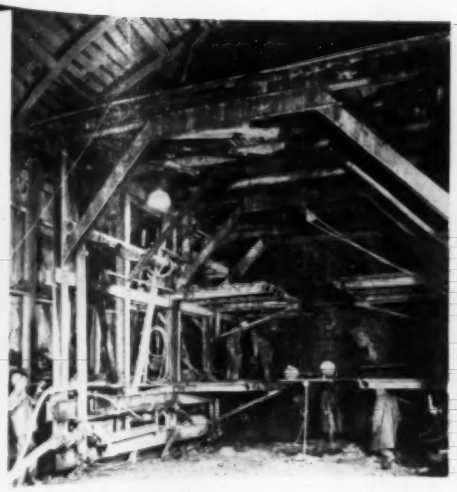
(*Continued on page 80*)

Model Predicts River Action During Construction of Huge Ramapadasagar Dam



MODEL OF Ramapadasagar Dam site on Godavari River, Madras, India, tests right-bank cofferdam. Constructed in St. Anthony Falls Hydraulic Laboratory, Institute of Technology, University of Minnesota, on horizontal scale of 1:250 and vertical scale of 1:100, model represents 2½-mile stretch of river. When action of model is checked against action of river, complete working model will be available to test all stages of construction.

Laboratory technician kneels near center of river model at island where break in alignment of dam takes place. Tags on white cord, representing center line of dam, are at 400-ft intervals. Construction cofferdams will be anchored to island as river is shifted from side to side during construction. Flood discharge of Godavari River—2,000,000 cfs—about equals that of lower Mississippi River at flood stage. Tests are headed by Dr. Lorenz Straub, M. ASCE, Director of Laboratory.



FACILITIES AT EAST PORTAL include quonset huts for offices, engineering and supply departments and lockers. Quonset nearest portal houses compressors (see interior view at bottom of page, left) which supply all air for drilling. South bore, at right in view above, was started first and fan for its ventilation projects from tunnel in center foreground. In background, far left, appear concrete arches for approach bridge over Nine-Mile Run. Drilling jumbo for north bore is being assembled in left foreground. Two 38-ft-long jumbos, one for each bore, were fabricated on job of structural steel and wood deck. Mounted on rails, they are pulled to and from face by bulldozer.

DRILLING JUMBO at north-bore heading (top, left) mounts 16 Joy drills, six more than south-bore jumbo, in effort to catch up with south bore. Jumbo is also used to place steel ribs on 4-ft centers to hold unstable roof rock. With center panels of jumbo down (above), Lorain and Northwest shovels and Euclid trucks (see cover) can pass through to muck out at face.

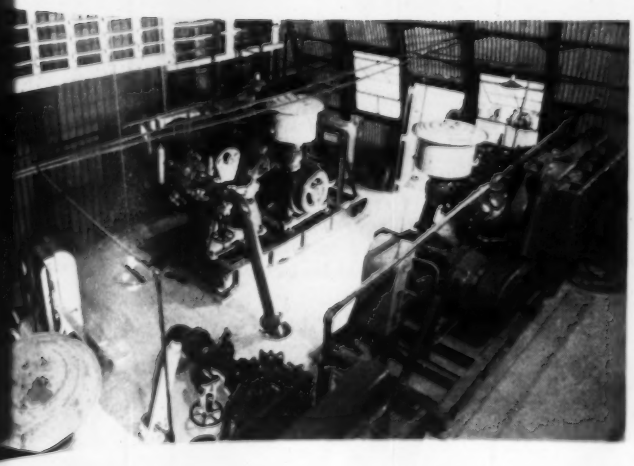
Twin Bores of Squirrel Hill Tunnel Each Advance 24 Ft per Day

LARGEST SINGLE PROJECT ever put under contract by the Pennsylvania Department of Highways is the Squirrel Hill Tunnel now being driven from the east portal by B. Perini & Sons, Inc., Framingham, Mass., with George D. Phillips, Assoc. M. ASCE, as chief construction engineer. The $13,767,843.10 contract for construction of the tunnel proper excludes equipment, ventilation buildings, interior finish and paving. The tunnel is an important link in the Penn-Lincoln Parkway East, designed to relieve traffic congestion to and from Pittsburgh. (See symposium and article by Ole Singstad in CIVIL ENGINEERING for December 1948.)

Average drilling cycle is $8\frac{1}{2}$ hours, divided as follows: Drilling, 90 min; loading holes, 40 min; moving jumbo back, 15 min; shooting, 10 min; ventilating, 40 min; bulldozing fly rock, 20 min; mucking out, 200 min; moving jumbo back to face, 15 min; setting steel tunnel ribs, 90 min.

The drill pattern consists of 114 holes V-cut, so allocated that not more than 9 holes need be drilled from each drill station on the jumbo. Steel used is Crucible, $1\frac{1}{4}$-in. round lugged hollow, processed by Iron City Spring Co., Pittsburgh. Bits are Timken, Type H, sidehole, detachable, stepped down in $\frac{1}{8}$-in. steps from $2\frac{1}{4}$ in. to 2 in. for 10-ft holes. Blasting is by the electric-cap method, using delays of 1-sec intervals in numbers 0 to 13. Hercules detonators and gelatin extra-strength powder are used.

EACH HEADING is ventilated by Joy Axivane axial-flow fan (left) of 54-in. diameter powered by 75-hp motor. Fans are used for blowing only. As working face advances, breakthroughs between twin tubes are driven every 500 ft. Two fans from portal are moved up to each new breakthrough to act as scavenger fans. Air is blown into south bore by three additional fans placed in air lock at south-bore portal and is blown out north bore by scavenger fans in north bore. As each new breakthrough is driven, breakthrough behind is closed off. (Below, left) Compressor room in quonset contains four heavy-duty Joy compressors which supply air for drilling at 125 psi. (Below, right) Jumbo for north bore is readied for first drill round, south bore having already been driven 200 ft.



Unique Two-Barge Technique Expedites Placing of Cofferdam Bracing for Bridge Piers

L. L. BRINK, Jr., Jun. ASCE
Dravo Corp., Pittsburgh, Pa.

TWO STEEL DECK BARGES were used in placing the cofferdam bracing for the river piers of a new bridge over the Monongahela River at Dravosburg, Pa., near Pittsburgh. The piers will support a 1,931-ft high-level bridge which will carry two street-car tracks and four vehicular lanes. The main span of 500 ft stretches between the two river piers, with ten land piers and two abutments supporting the remainder of the structure. The project was performed for Allegheny County by the Dravo Corp. This bridge will replace an antiquated wood and steel structure built in 1889 which is inadequate for the present traffic volume. The high-level bridge is designed to accommodate express traffic and to eliminate two hazardous grade crossings where two main-line railroads parallel the river.

Each steel sheetpile cofferdam was 31 ft 11 in. wide by 94 ft 9 in. long. The bracing for the pier No. 3 cofferdam had three sets of wales, two sets made of steel beams with timber buntons and the third set made of 16×16-in. timbers. The bracing for the pier No. 2 cofferdam had four sets of wales, three sets made of steel beams with timber buntons and one made of 16×16-in. timbers. The same method of placing was used for both cofferdams.

The two 30×120-ft barges used in the construction were placed parallel to each other and 36 ft apart. Two steel beams, one across each end of the two barges, held them in position. Next, six timber beams were placed across the span with the ends of the beams resting on the barge decks to temporarily support the bottom set of walers. Rod bolts were used to hold the bottom set of wales about 2 ft above the water line. Spreader posts were placed on the bottom set of wales so that the set above it could be framed. Heavy diagonal bracing was used in both directions between these two sets so that the unit would act as a truss to carry its own weight and that of the wales subsequently added.

After the diagonal bracing was completed, the two sets were lifted by hoists mounted on 36-in. WF beams which rested on timber bents built on the barges. The temporary supporting timbers then were removed leaving the two lower sets of wales suspended from the hoists. Each hoist had two drums, one of which was attached to each side of the bracing with a six-part line. Any corner of the bracing then could be raised or lowered independently of the others. Steam for the hoists was supplied from a derrick boat.

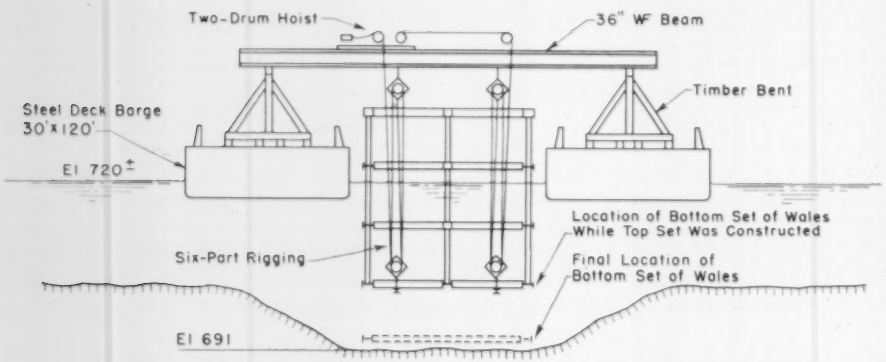
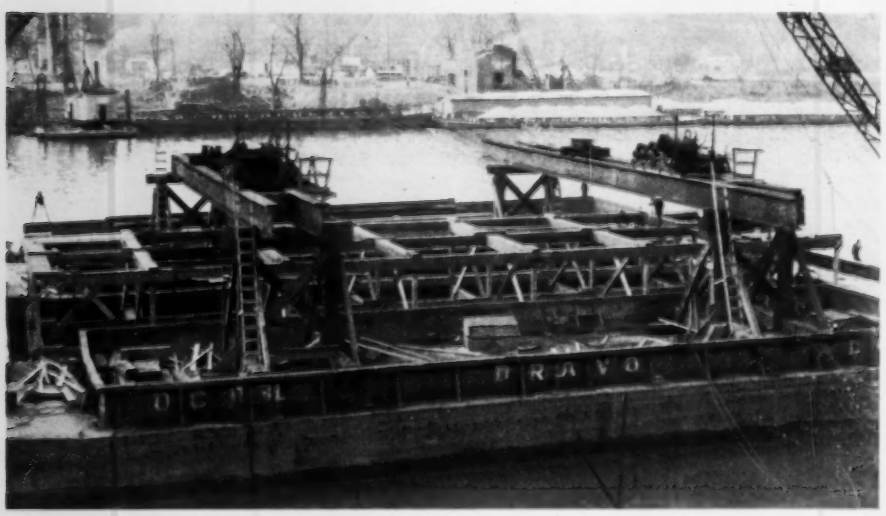


FIG. 1. HOISTS on WF beams (above) supported by barges lower cofferdam bracing into position. Six-part rigging placed at each corner of bracing permits corners to be raised or lowered independently. Bottom set of wales was assembled on six timber beams which spanned gap between barges. After first two sets of wales were erected, load was transferred to four hoists, and timber beams were removed.

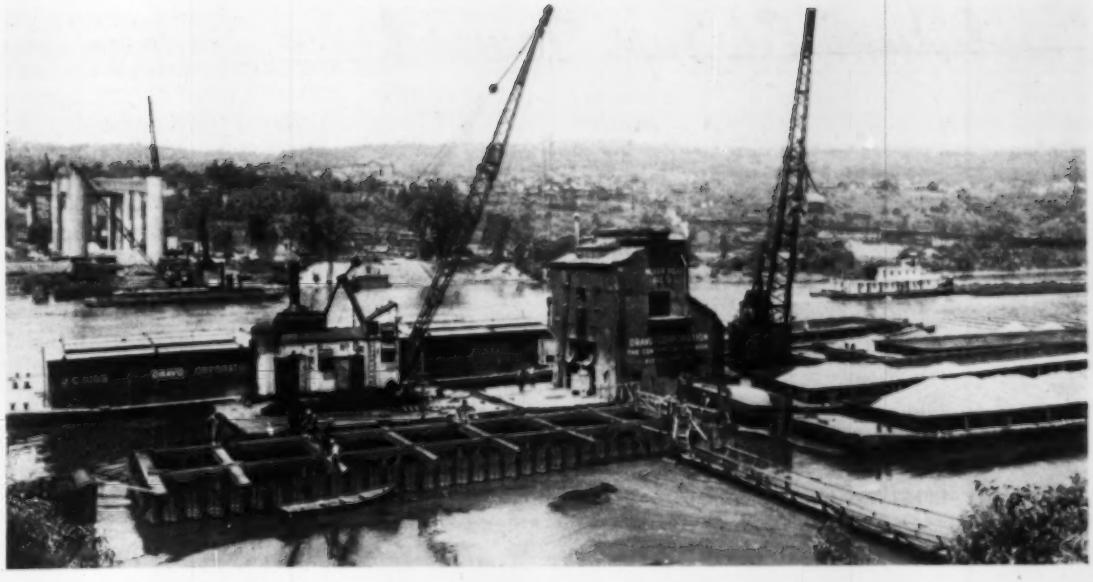
Unit Moved Across River to Site

Three of the four sets of wales were completed while the barges were moored to the west bank of the river, where the construction work yard was located. The entire unit then was moved across the river to the pier site, which had been previously dredged. The three sets of wales were suspended from the hoist during the movement across the river because the water was not sufficiently deep to move them completely submerged.

The barges were located over the pier site and the wales were lowered far enough for the top set to be framed. Then the entire assembly was lowered until the top was about a foot above the water. At this



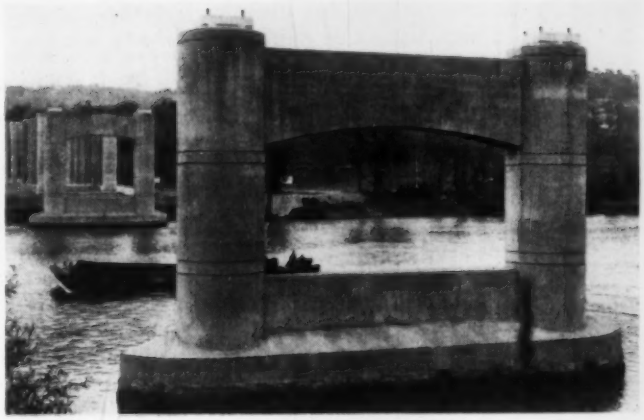
TWO STEEL DECK BARGES (left) support drum hoists which are shown resting on 36-in. WF-beams. Hoists will carry assembled bracing and lower it into position in previously dredged trench. Lower three sets of wales were assembled while barges were moored to west bank, where construction work yard was located.



BRACING (seen in place at right) was lowered until top set of wales was about 1 ft above water. M116 steel sheetpiling was driven into position around bracing and bracing was lowered into final position. Cables were used to fasten bracing to sheetpiles. Lines from hoists then were released, barges floated away, and cofferdam pumped out. In photo, floating concreting equipment is beginning operations.

point, the bracing was positioned accurately and M116 sheetpiling was driven around it, except where the hoist support beams prevented this phase of the work. The bracing was lowered to its final position and tied to the sheetpiling with cables. The lines from the hoists were released and the barges floated away from the area. The gaps in the piling then were filled and the cofferdam pumped out.

The use of deck barges for this operation had several advantages over the usual methods of hanging the sets of wales on pile clusters or steel sheetpile cells. The same equipment can be used on both piers; also, the major part of the work can be completed near the work yard area, with the attendant savings due to ready accessibility for the workmen and proximity to workshops. The barge decks made an excellent work area for cutting and fitting the members, and also could be used for storage.



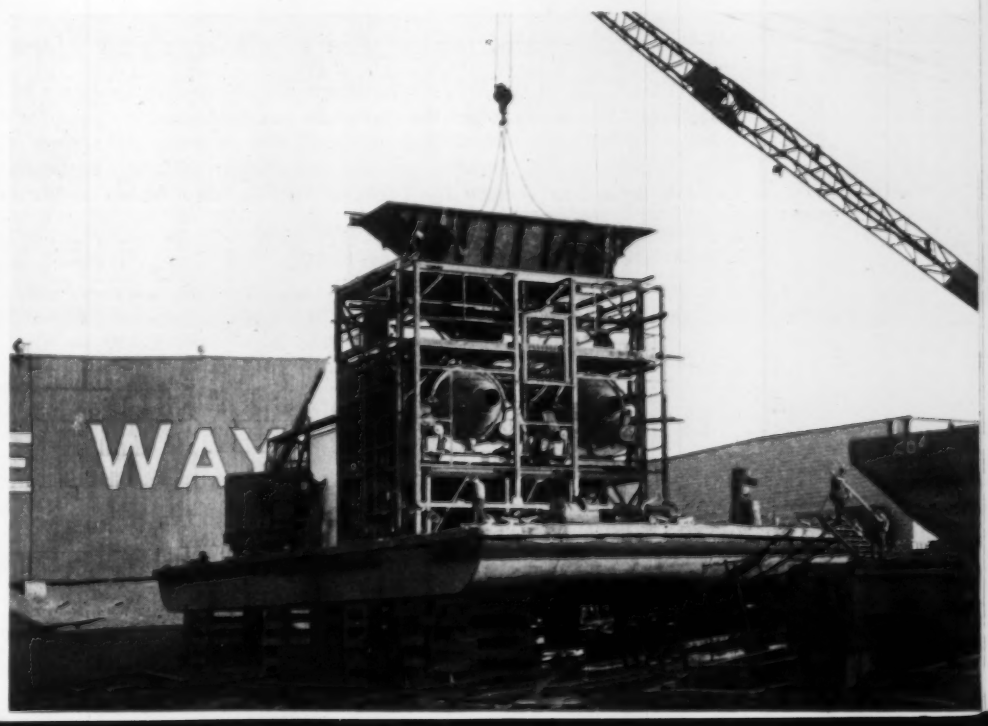
COMPLETED piers (right) are ready to carry new highway across Monongahela River at Dravosburg, Pa. Bridge is 1,931 ft long, with main span of 500 ft between river piers.

On the project, Bruce Bracey, supervisor, was in charge of inspection for Allegheny County. B. N. Parker and the writer were superintendent and engineer, respectively, for Dravo Corp.

Remodeled Concrete Mixer Boat Produces 80 Cu Yd per Hour

A MIXER BOAT with a capacity of 80 cu yd of concrete per hour is being used for construction of the lock and dam being built on the Monongahela River at Morgantown, W.Va., by the Corps of Engineers, U.S. Army. The boat is here seen at Dravo Corporation's marine ways in Pittsburgh, Pa., where it was remodeled by lengthening the hull 10 ft and installing two tilting-type mixers and accessories. When it is in operation, sand, gravel and cement are loaded into the batchers by a whirler crane.

The boat was remodeled for use by the Contracting Division of Dravo Corp, which is now building a cofferdam at the dam site to detour the river flow during erection of the permanent structures.



Pendulum Swings Toward

Broadening of Curricula in Engineering Education

HAROLD E. WESSMAN, M, ASCE

Dean, College of Engineering, University of Washington, Seattle, Wash.

IN ENGINEERING EDUCATION as in other fields, it would appear that history repeats itself and that the pendulum swings from one extreme to the other. A century ago the emphasis was on a broad liberal education. Then, with the increase in scientific and professional knowledge, it switched to a highly technical education. Now it is tending in the other direction.

The writer was a member of the committee appointed in 1939 within the American Society for Engineering Education to study the aims and scope of engineering education, resulting in the three main recommendations listed in the box below. The recommendation that a four-year program is sufficient for many students was based on the fact that there are many peripheral and allied positions in engineering fields for which high technical competence is not a prerequisite. The committee believed that science and technology subjects should dominate the four-year course, but that a carefully planned stem of humanistic-social studies should be integrated with the science-technology stem and studied concurrently. There was no attempt to specify particular courses but the committee defined six chief aims of the liberal stem as follows:

Aims of Humanistic-Social Courses

1. An understanding of the evolution of the social organization within which we live, and an understanding of the influence of science and engineering on its development.
2. The ability to recognize and make a critical analysis of a problem involving social and economic elements.
3. The ability to organize thoughts logically and to express them clearly and convincingly in both spoken and written English.
4. An acquaintance with some of the masterpieces of literature, and an understanding of their setting and influence upon civilization.
5. The development of moral, ethical, and social concepts essential to a personal philosophy, to a career consistent with public welfare, and to a sound professional attitude.
6. The attainment of an interest and pleasure in these pursuits and thus the inspiration to continue to study them.

These aims constitute a large order. The second in particular may seem like "shooting at the stars." However, it is possible to develop enough interest on the part of the student in some of these fields so that he will pursue them further after graduation.

The committee made another significant recommendation—that any school should be free to experiment with any pattern of engineering education which it considered best. This is a democratic recommendation, which recognizes that it is against the American tradition to attempt to impose a fixed pattern on every school.

What have been the results of these recommendations, which were reaffirmed by a subsequent ASEE committee in its report, "Engineering Education After the War"? Almost every engineering school in the country has studied and revised its engineering curricula and reappraised its science and technology content. A decided effort is being made to give more effective instruction in English, public speaking and technical report writing. Courses in literature and government have been introduced. Some familiarity with the historical and social background of our contemporary civilization is being achieved. More and more students are being encouraged to continue into graduate study and research. Some schools have instituted a five-year program

Results of ASCE Seattle Section Discussion Agree with Recommendations of ASEE Committee on Aims and Scope of Engineering Education

AT THE CLOSE of the talk abstracted in the above article, given before the Seattle Section of ASCE, Dr. Wessman asked the audience the questions in the right-hand column below. In a discussion lasting for more than an hour, the answers given were the preponderant views of this Society group, showing general agreement with the recommendations of the committee of the American Society for Engineering Education, listed in the left-hand column.

Recommendations of ASEE Committee

1. Introduction of a carefully planned and integrated stem of humanistic-social courses which would take about 20 percent of the student's time and which would be taken concurrently with the courses in science and technology.

2. Retention of the four-year undergraduate program leading to a bachelor's degree in engineering.

3. Increased emphasis on graduate study in science and technology for the best of the four-year students to fit them for the highest type of professional practice, research and teaching.

Results of Seattle Section Discussion

1. Is it worth while to give our engineering students more training in English composition, English literature, public speaking, history, economics, social relations, and similar subjects?
   Answer, preponderantly "Yes."
2. Should a five-year undergraduate program be required of all engineering students?
   Answer, preponderantly "No."
3. How can the best undergraduate students be influenced to spend additional years in graduate study?
   Answer, "Generous financial subsidies by the colleges for graduate students."

but these are so few in number, only about 3 percent of the total, that it is not justifiable to conclude that there is a definite trend along these lines.

Wide Variety of Curricula Successful

A study of civil engineering curricula in 114 different engineering schools would indicate that it is unwise to be dogmatic about engineering education. This study was made by the ASCE Committee on Engineering Education, of which the writer was a member from 1944 to 1948. A wide range of educational patterns was found in the schools studied. The civil engineering content in the curricula ranged from 15 to 42 percent; the mathematics content from 6 to 17 percent; the content in the physical sciences such as physics and chemistry, from 9 to 22 percent; and the content in basic mechanics, from 6 to 15 percent. Every one of the 114 schools will argue earnestly that they are doing a good job in engineering education. It is obviously very difficult to evaluate quantitatively any particular type of educational plan. Every school in the country has outstanding graduates who have made notable records in the practice of engineering and to whom the school will point with pride as evidence of the quality of its education.

The ASCE committee endorsed the 1940 and 1944 reports of the ASEE committees with some rather limited qualifications. The ASEE committees had urged that industry and the engineering profession, as well as schools and colleges, give united support to recognizing technical institute programs. The ASCE committee felt that the creation of a large number of such institutes for training technicians for subprofessional jobs in civil engineering might do more harm than good, both by providing a means of access into the profession for men with poor qualifications and by graduating men who would preempt many subprofessional jobs which now give the necessary preliminary experience to young engineering graduates on the road to more responsible professional positions.

Membership Opinion Shown by Questionnaire

In 1945 the ASCE committee made a survey of membership opinion on the educational needs of civil engineers. A questionnaire prepared in cooperation with a committee from the Civil Engineering Division of the ASEE was sent to 2,700 ASCE members in all parts of the country. The great majority of the 1,000 who replied indicated that graduates of the preceding 10 years were clearly deficient in the ability to write a clear, orderly letter or report, and to address a private or public gathering. They believed that report writing, English composition, and public speaking should be at the top of the non-technical subjects in the curriculum.

Economics, labor relations, American government, public administration, psychology and business law were the other non-technical subjects given a high rating. History and English literature were at the midpoint; philosophy, music and art at the bottom. The survey of the curricula brought out the important conclusion that it is possible to devote approximately 20 percent of the time to non-technical subjects and still include fundamental science and technology courses in the four-year curriculum.

In the survey of the relative importance of civil engineering subjects, reinforced concrete theory and design was at the top of the list and geodetic surveying (formerly considered so important) was at the bottom.

In including subjects other than technical in the engineering curricula, stress should be laid on the need for the highest type of teaching ability. Only too often an English

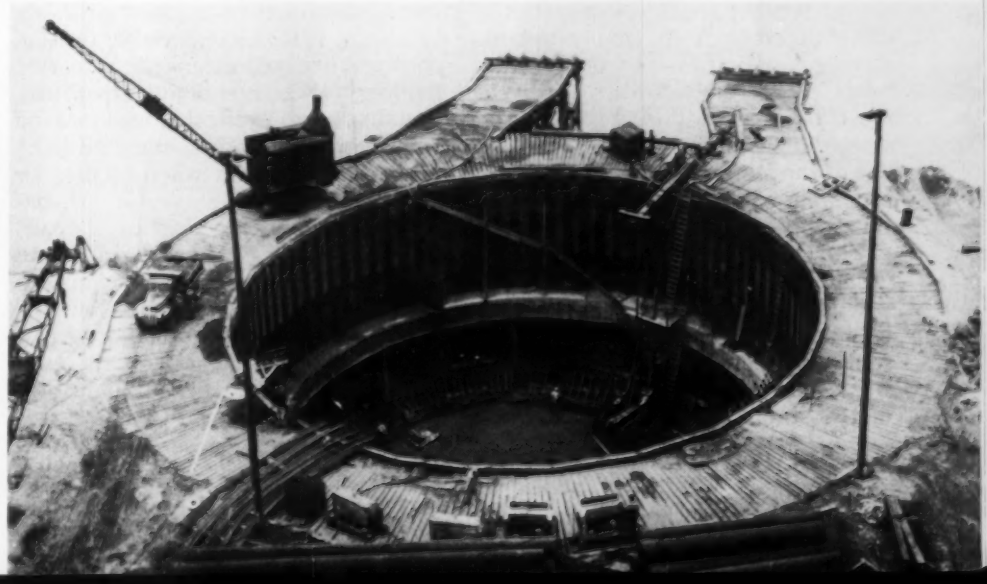
(*Continued on page 87*)

Sheetpile Cofferdam of 97-Ft Diameter Built Without Cross Bracing

USE OF CONCRETE RING WALES instead of the usual "spider" or cross bracing leaves the entire area of a 97-ft-dia cofferdam open for the construction of an intricate, heavily reinforced pump-well structure, part of the circulating-water intake for a large addition to the Union Electric Power Co. plant at Venice, Ill. The cofferdam, located on the bank of the Mississippi opposite St. Louis, is the first of its type and size in the country. Initial construction step was the driving of a ring of Z steel sheetpiling 73 ft long. After excavating to a depth of 24 ft, the first concrete ring wale, 4 × 4.5 ft, was formed and poured. Excavation was continued to a depth of 38 ft, where the second concrete wale was poured. Forms for this wale are being placed in photograph, at right.

Drilling equipment was set up inside the cofferdam for the installation of 20 Drilled-In caissons, a type of special heavy-load piles. In this operation, 30-in. pipe was driven 45 ft to rock, a churn drill was used to cut a 4-ft socket in the rock, a steel H-core was placed, and the caisson concreted. Excavation for the stage following was done by a hydraulic dredge floating inside the cofferdam. Next, a reinforced concrete mat was placed in the cofferdam by tremie and the cofferdam unwatered.

When the permanent pump-well structure, now under construction, has been completed, the cofferdam will be backfilled to ground level and the sheetpiling pulled. Ring wales will be left in the ground. Stone & Webster, Inc., are engineers for the cofferdam, which is being constructed by the Western Foundation Corp.



LABORATORY BUILDING FOR RESEARCH PLANT houses facilities for from six to ten technicians and graduate students. Measuring tank, at left, permits complete control over quantity of sewage diverted to each system in adjoining research treatment plant. Constant measured quantities are fed to primary sedimentation tank (seen in another photograph) and to Imhoff tank.

Sewage Treatment Research Plants Study Special Florida Conditions

C. D. WILLIAMS and DAVID B. LEE, Members ASCE

Respectively, Head Professor of Civil Engineering, University of Florida, Gainesville; and Chief Sanitary Engineer, Florida State Board of Health, Tallahassee

TREMENDOUS ECONOMIC IMPORTANCE attaches to the problems of sewage treatment and disposal in Florida because of the interrelation between sewage disposal and water supply. Since most of the surface drainage passes into the underground system and much of the water supply is drawn from underground sources, complete treatment is necessary. Recognizing the importance of sewage treatment to the health of the people of the state, the State Board of Health and the University of Florida have inaugurated a program of research to determine the best procedures and installations to meet Florida conditions. Two installations at the university are being used in this program—a small research plant and the new treatment plant for the university as a whole, incorporating special design features to increase its value as a research medium while at the same time serving the practical purpose of treating the sewage from the university community.

PROBLEMS RELATED TO sewage disposal in Florida are unique only in that many of the conditions occurring singly elsewhere appear to be grouped in this state. Few complete sewage treatment plants are in operation; urban communities are generally small in size and widely distributed. The resident population of the average city is computed at 6,373, which has a definite bearing on the problem as the economics of sewage treatment plants serving small communities is quite different from that of plants serving large cities. In many cities relatively larger quantities of sewage must be treated during the winter season than in the summer, because one of the state's chief industries is to provide for its winter tourist population.

The interrelation between underground water and surface runoff by way of a vertical drainage system offers a real challenge to Florida sanitary engineers in the matter of waste disposal. About 90 percent of the state's drinking water is procured from wells, and it has been frequently demonstrated that the water from many wells comes almost directly from surface drainage through sink holes.

Research Needed on Variety of Problems

Conventional methods of sewage treatment have been largely developed in northern climates. Since the winter temperature in Florida averages considerably higher and more uniform than in most northern locations, it seems reasonable to conclude that recommended rates of loading for conventional treatment systems, and even the methods of treatment themselves, may be subject to modification when applied to Florida conditions.

During 1946, the Bureau of Sanitary Engineering of the Florida State Board of Health approved plans for sewage treatment and collection systems estimated to cost more than eleven million dollars. It is estimated that nearly fifty million dollars of new work is in various stages of planning, from preliminary studies to actual construction.

Recognizing the tremendous economic and health importance of the various methods of sewage treatment, the State Board of Health and the University of Florida have inaugurated a program of research, to include a critical review of the entire gauntlet of criteria. Recognized rates of loading for trickling filters, digestion rates, sludge drying methods, and many other criteria will be checked with actual operation. Florida materials will be studied to determine their economic suitability for use in filters. Many treatment criteria may need to be modified to suit these materials. To effectuate this research program two installations have been set up at the University of Florida—a small research plant (Fig. 1) and a full-size plant (Fig. 2) which serves both to treat the university's sewage and as a testing and instructional center.

In common with most universities and colleges, enrollment at the university rose rapidly during 1946 and 1947. In the summer of 1946, it became evident that the sewage plant serving the university would need to be enlarged quickly. An auxiliary plant was designed with two main purposes: (1) To supplement the existing plant until a larger and more modern plant could be constructed for the whole university, and (2) to serve later as a research laboratory.

Research Plant Built

Members of the civil engineering staff at the university had been studying Florida's research needs in this field for some time, had held numerous conferences with engineers of the state, and had developed preliminary plans for the research plant. Funds were provided by the Florida State Improvement Com-

mission and the plant was constructed during the summer of 1946 (Fig. 1).

The laboratory building is shown in a photograph. Flow through the plant (Fig. 1) commences with a pumping station which pumps the raw sewage to the measuring tank which appears in the same photograph. Effluent from the primary treatment may flow to either of the two dosing chambers and thence to one of the sand filters or to the trickling filters.

Secondary clarifiers are provided after each trickling filter and the final effluent is chlorinated. Continuous operational records are being kept and several separate phases of the operation have been isolated as individual projects. The Wallace and Tiernan Co. sponsored a fellowship in chlorination of sewage, which is now being continued at this plant.

Full-Size Plant Also Designed to Aid Research

Before the research plant was built, during May 1946, the Reynolds, Smith and Hills Co. was retained as consulting engineers for the preparation of plans for the full-size treatment plant at the university. The principal purposes of the new plant were to effectively treat the maximum probable load from the university community with a high degree of removal, and at the same time to provide a second facility to further the research and instructional purposes of the university. The Civil Engineering Department was designated as responsible for establishing design criteria. Conferences were held between engineers of the Bureau of Sanitary Engineering, the Civil Engineering Department of the University and consulting engineers. The greatest possible flexibility, complete volumetric control and record, and neat appearance were considered desirable.

In May 1946 enrollment at the university was 2,940 students—slightly less than the peak prior to the war. Predictions were that it would reach 5,000 by the fall of 1946 and 10,000 by 1956. How close the estimate will be for 1956 is of course not known but enrollment exceeded 7,200 in the spring of 1947 and reached 10,000 by the fall of 1948.

In analyzing the equivalent population to establish the peak design load, consideration was given to such factors as the number of students living on the campus and contributing 100 percent, the number living off the campus, and the faculty and service employee contribution. On the basis of a student enrollment of 10,000, it was estimated that a 6,547 population equivalent should be used. To allow for shifts in estimated percentages, a value of 7,000 persons contributing 100 gal per day per person resulted. The equivalent university population is almost identical with that of the average urban community in the state—computed at 6,373 persons.

Great variations in sewage flow occur at the university because of vacations, holidays and the less-well-attended summer session. The maximum probable plant capacity was

SAND FILTERS at University of Florida's research plant are filled with sands of different effective sizes and to varying depths. Each filter has surface area of 1/800 acre. One graduate thesis has been completed and considerable additional data are being collected on effects of rates of loading on degree of treatment.

RAW SEWAGE from measuring tank in research plant flows to primary sedimentation tank (right, foreground) or to Imhoff tank or to both simultaneously. At upper center is seen one of two dosing tanks and at upper right, framework of square trickling filters. Round trickling filters of similar construction are located beyond, to left. Results of using various Florida materials in trickling filters are now being studied.

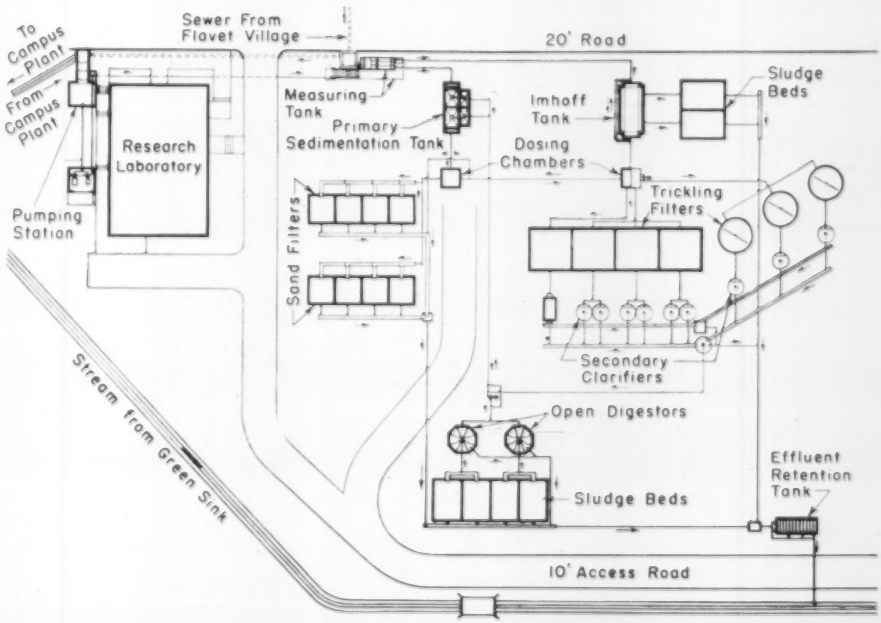


FIG. 1. DIAGRAMMATIC DRAWING of research sewage treatment plant at University of Florida indicates design provisions for treatment of 30,000 gal per day by each of two conventional primary systems, followed by various secondary treatments. Plan provides complete control of flow and maximum flexibility.

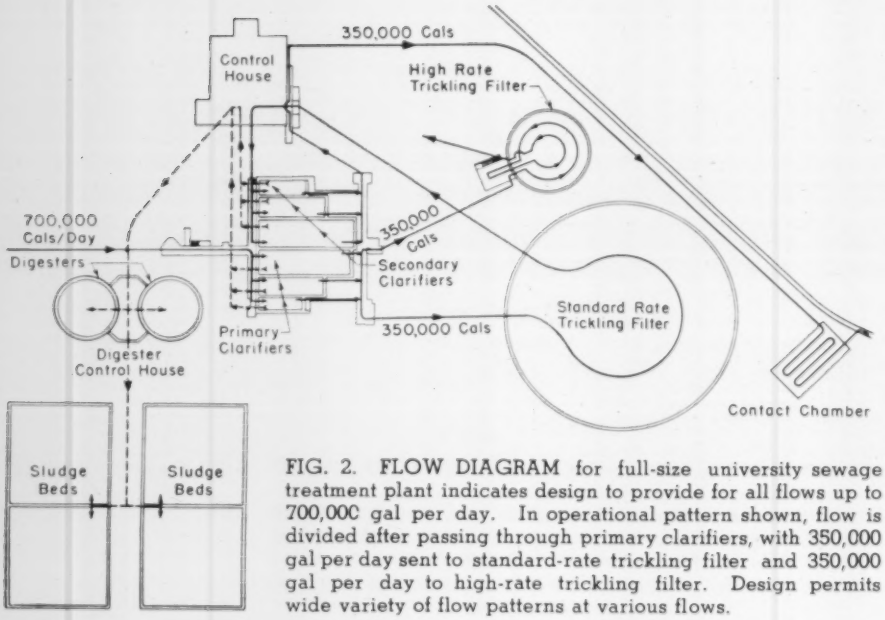


FIG. 2. FLOW DIAGRAM for full-size university sewage treatment plant indicates design to provide for all flows up to 700,000 gal per day. In operational pattern shown, flow is divided after passing through primary clarifiers, with 350,000 gal per day sent to standard-rate trickling filter and 350,000 gal per day to high-rate trickling filter. Design permits wide variety of flow patterns at various flows.

therefore established at 700,000 gal per day and the minimum at 100,000. Because of the seasonal tourist population, this variation appears to be typical of many urban communities in Florida. Solution of the problem of greatly varying sewage flow appears to be in the provision of unit type treatment, permitting the minimum flow to be treated under conditions equivalent to the treatment of the maximum flow. This aim was met by providing primary clarifiers having capacities of 100,000, 200,000, and 400,000 gal per day with a detention period of two hours. This combination permits the treatment of any multiple of 100,000 gal per day up to 700,000 at the design detention period. This same general plan is carried out in the design of the secondary clarifiers. By placing the three primary clarifiers adjacent to the three secondary clarifiers, several common walls are secured, so that the secondary clarifiers can be converted to primary should the need for expansion ever occur.

Typical Flow Diagram Explained

Figure 2 shows the schematic layout of the university sewage plant and one of the most probable flow diagrams. All raw sewage from the campus and residence dormitories enters the plant from the north, passing first through a comminutor installed in the end of a Parshall flume structure, equipped with a continuous recording flow meter.

From the Parshall flume, raw sewage enters the influent channels of the primary clarifiers, where it can be directed to one of the three primary tanks by means of a gate control system. Effluent from any primary clarifier can be directed to the standard-rate trickling filter or to the high-rate trickling filter.

From the trickling filters, the effluent flows by gravity to wet wells in the control house, whence it will normally be pumped to the secondary clarifiers. However, the sewage can be returned to the primary clarifiers in any proportion for recirculation.

One of the most important features of the plant is its great flexibility of operation. A wide variety of flow patterns are possible. Effluent from the clarifiers may pass through the high-rate trickling filter alone or through the standard-rate trickling filter alone. Pumps in the high-rate filter pump house permit recirculation through this filter. When a low flow enters the plant, the raw sewage can be routed through whichever primary clarifier suits the quantity being treated. If the influent is at the rate of 100,000 gal per day this quantity can be joined at the influent flume by another 100,000 gal of recirculated filter effluent, and the combined 200,000 gal per day passed through the intermediate primary clarifier which provides two-hour detention, then to the standard-rate trickling filter. The effluent from the filter is divided at the control house, with one-half being recirculated and one-half chlorinated and transmitted to the stream. A meter installed in the Parshall flume in the effluent channel at the control house measures the flow leaving the plant.

Metering and control devices are provided at all strategic points to permit positive control and collection of complete data. The influent channels leading to the primary clarifiers have been designed hydraulically to distribute the flow in the proper proportion to each clarifier. Adjustment in the flow is provided by means of vertical gates. In the various channels throughout the plant 62 vertical gates permit control of direction and quantity of flow. The effluent from any primary clarifier can be metered by the use of one of two meters installed in the effluent system. These meters also measure the quantities being delivered to the standard-rate and high-rate trickling filters. Flow meters are provided on the pump line from the control house to the secondary clarifiers and on the recirculation line from the control house to the primary influent.

The control house provides an adequate laboratory for running the usual tests, and contains the plant pumping system. Automatic samplers bring samples from the wet wells to the refrigeration unit in the laboratory.

The effluent is diluted with an equal amount of continuously flowing water. The stream empties into a ponded area of about 120 acres, called Lake Alice. The pond has a drainage area of about 1,200 acres and overflows into a natural sink area. Tests of the water entering the sink indicate that the ponding gives results in purity, chemically and bacteriologically, comparable to that furnished by most drainage basins.

Sludge from the primary and secondary clarifiers is pumped into separate digesters. While the digesters have been provided with floating covers, only one cover has been installed to permit studies of effectiveness and operating characteristics with and without covers. Sludge in the digesters can be recirculated and the covered digester has temperature control. Gas from the covered digester is metered and used for laboratory and heating purposes. Digested sludge passes from the digesters to one of four sludge beds for final drying and disposal.

The plant is designed for an average 24-hour flow of 700,000 gal per day, an average 16-hour flow of 875,000 gal per day, a maximum 4-hour flow of 1,225,000 gal per day, a momentary peak flow of 2,100,000 gal per day, and no groundwater infiltration. Design characteristics of sewage are a 5-day B.O.D. of 200 ppm, 240 ppm of suspended solids, and negligible ether-soluble matter.

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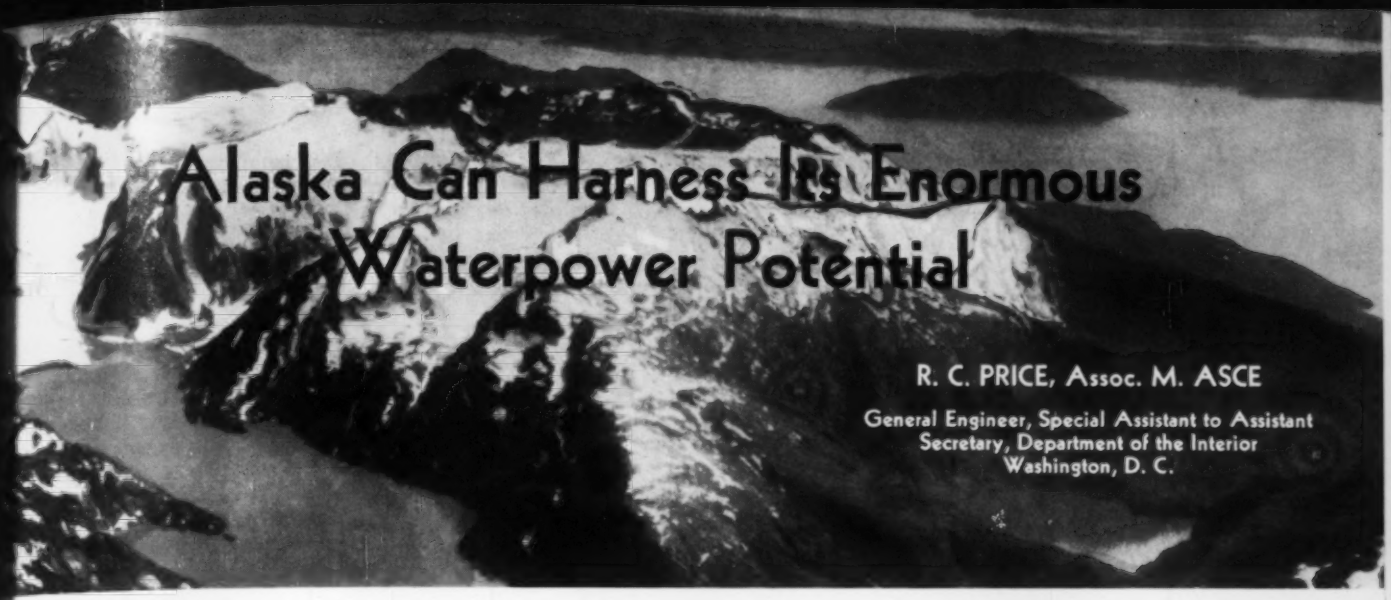


Alaska Can Harness Its Enormous Waterpower Potential

R. C. PRICE, Assoc. M. ASCE

General Engineer, Special Assistant to Assistant Secretary, Department of the Interior
Washington, D. C.

POWER PLANT at sea level on Taku Inlet (in background) could take water from Lake Dorothy (in foreground), which is 16 miles from Juneau and 2,400 ft above sea level. Proposed hydroelectric plant would have 2,330-ft head and could supply 100 million kwhr annually.

ALASKA IS ENTERING an era of development that is long overdue. Although the Territory is rich in natural resources, the full extent of her wealth is yet to be determined. It is generally recognized that finding and appraising this wealth as well as conserving and developing it for the national good are responsibilities of the federal government, particularly the Department of the Interior. Realizing this, the Eightieth Congress requested the Bureau of Reclamation of the Department to investigate the potential development of Alaskan water resources.

Thus far, only the major rivers have been reconnoitered by Bureau engineers, but hydroelectric power sites already found have potential production in excess of 50 billion kwhr annually. This approximates one-fifth the entire power production by United States utilities in 1947.

Not a Frozen Wasteland

Those who envisage Alaska as an inhospitable and frozen wasteland might question the need for development of the Territory. Actually Alaska is no closer to the North Pole than Norway, Finland or Sweden and winter temperatures are comparable to those of Montana, Minnesota and Maine. Much of Southeastern Alaska has a climate very similar to that of Seattle. Precipitation in most of Alaska is the same as in desert lands of the western states. The average annual precipitation of 150 in. in the southeastern humid region quickly drops to 15 in. or less north of the Alaska Range and steadily decreases to 5 in. on the Arctic coast.

Physically, Alaska is so irregular in shape that with an area only one-fifth that of the United States, it extends one-sixth of the way around the world (Fig. 1). The relief is strong, resembling that of the western states. Glaciers, covering whole mountains and alpine valleys, far surpass those of Switzerland both in number and magnitude. The Alaska Peninsula is one of the most active volcanic regions in the world. Forests cover much of the country. Principal known mineral resources are coal, petroleum, antimony, lead, zinc, copper, arsenic, graphite, nickel, chromite, tungsten, iron, mercury, tin, silver, gold and platinum.

Economically, Alaska is undergoing some pronounced growing pains. Need of an adequate supply of low-cost power is one of the most acute. The territory is developing so rapidly that in many communities power demands are far ahead of existing power generating facilities. In several localities present power production costs are so high as to hinder further development. In some towns diesel oil for power generation costs more than $6 a barrel.

Lack of low-cost power coupled with other deficiencies can often require a complete readjustment of normal economic values. Under present conditions in many parts of interior Alaska, deposits of strategic minerals that under ordinary circumstances would be considered as having great value cannot be mined because it would not be profitable to extract the ore by crude methods and transport it by air freight. In all of Alaska the total developed horsepower of hydroelectric plants is only 46,000. It is want amidst plenty for there are so many good hydroelectric power sites that even the most remote corner of the country is easily within modern power transmission distance for any reasonable quantity of power that could be developed.

Anchorage particularly is a power-deficient area. Today the city of Anchorage is six times its prewar size and still growing. In an attempt to meet the rapidly increasing demands for power, the stern half of a wrecked tanker has been beached and its

FIG. 1. RECONnaissance of Alaska's major rivers by engineers of Bureau of Reclamation indicates power potential of feasible hydroelectric sites to be more than 50 billion kwhr annually. With area of only one-fifth that of United States, Alaska extends one-sixth of way around globe.

power plant connected to the city system even though the cost of producing power on the ship exceeds the average retail selling price of power in the city. The only economical power source is the existing Eklutna hydro plant which in 1947 was able to supply little more than half the system's annual kilowatthour production.

Fortunately several federal agencies over a period of years collected basic data for enlargement of the Eklutna development. Late in 1948 the Bureau of Reclamation engineers, under the supervision of Joseph M. Morgan, Chief of the Bureau's Alaskan office in Juneau, and Richmond C. Johnson, Assistant Chief, completed studies of the site and submitted a report on the project, recommending approval for immediate construction. This multiple-purpose project would provide power production, recreation and irrigation, based upon the development of Eklutna Creek, midway between Anchorage and Palmer.

Terrain Favors Eklutna Development

Nature was kind. A glacier retreating up Eklutna Valley left behind a natural dam across the creek. Eklutna Lake, a body of water seven miles long and 200 ft deep, was thus created. Fortunately the lake lies 868 ft above the sea with only a narrow mountain intervening. Power could be produced by the simple plan of tunneling Eklutna's water through the mountain into a penstock running down the mountain side to a power plant at tidewater level. To protect the natural dam against any flood that might overtop, cut, or scour it, a concrete spillway is planned.

In winter time when the inflow of water to the lake almost ceases, or during drought years, power water would be drawn from lake storage. Placement of the tunnel inlet below the natural lake surface would make this possible. Excessive flows during summer months or during years of heavy runoff would replenish the supply of stored water. The tunnel through Goat Mountain to the Knik Arm side would be slightly less than $4\frac{1}{2}$ miles long. From the tunnel outlet, a 1,200-ft steel penstock $6\frac{1}{2}$ ft in diameter would lead to the powerplant. The tentative location for the plant is on the Anchorage-Palmer highway near Milepost 34. Installed capacity of the plant would be 30,000 kw. Transmission lines, one north to Matanuska Valley and another south to Anchorage, would be necessary—also substation facilities.

Firm energy available for normal use would total 100 million kwhr annually. Secondary energy, available only during certain hours, and increasing and decreasing during seasons of high and low lake levels, would total more than 43 million kwhr in the average year.

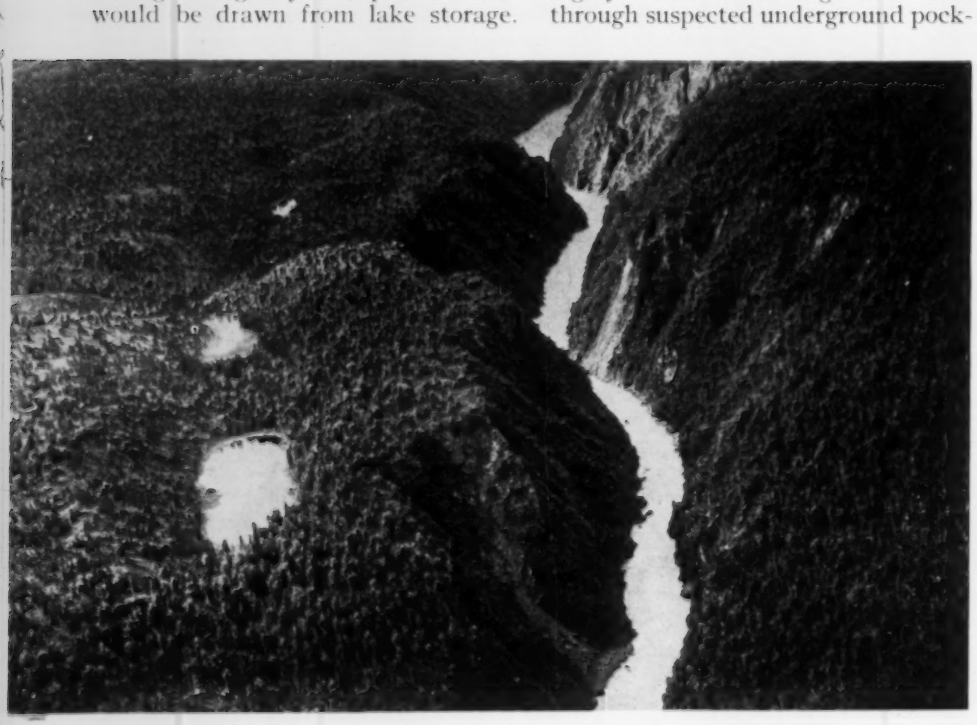
This plan of development evolved from several alternative plans that were investigated and discarded for various reasons. As an example, the construction of a series of dams down the canyon to develop Eklutna Creek below the lake would be economically infeasible because of the distance to impervious material in the streambed and abutments. Another plan would have involved a conduit from the lake to a point down the creek near the diversion works of the existing plant. The conduit route is on unconsolidated material with steep slopes and cut by deep side ravines. Further, climatic conditions would probably preclude winter operation unless the conduit were buried deeply. Such burial would involve construction in highly unfavorable ground and through suspected underground pockets of permafrost. All such plans stemmed from a natural desire to salvage and continue operation of the small existing power plant. However, rehabilitation and enlargement of this plant to take the full regulated flow of Eklutna Creek would be almost as costly as new construction and would only develop 27 percent of the power potentiality between the lake and the sea. Also, the existing plant would not be a total loss under the new development as it could be operated at least two months of each year during most years.

Development of the Eklutna Project is only a stepping-stone toward realization of a full-grown regional economy. The project is the first stage of a much larger plan for development of water resources in the fast growing and promising rail belt which extends from Seward on Kenai Peninsula through Anchorage and the Matanuska Valley over the Alaska Range and on to Fairbanks in the interior.

Cement and Pulp Industries Need Power

The capacity of the Eklutna Project would be fully utilized following completion, and studies are now under way to augment the proposed system with development of the water resources of Kenai Peninsula, Matanuska, Susitna and Nenana Rivers. This is the reason for including in the Eklutna Project a transmission line constructed for ultimate operation at 115 to 161 kv, whereas initial operation only requires 57-kv operation. The Eklutna Project is definitely an integrated part of a coordinated and comprehensive long-range plan for development of the abundant natural resources of the rail-belt area. A cement plant in this area, to meet Alaska's needs for this important material, will require new power capacity, and other proposed industrial developments would require substantially larger blocks of power.

The fact that the proposed Eklutna hydroelectric powerplant would be fully loaded following completion makes it essential to start the investigation of additional power sources now. At the present time it appears that the next development in the area would be in Devil Canyon on the Susitna River. It is located about 125 miles north of Anchorage and only 10 miles from the Alaska Railroad. The Devil Canyon Project would serve not only the Anchorage area but also several large new indus-



DEVIL CANYON of Susitna River, 125 miles north of Anchorage, Alaska, is believed capable of supporting 600-ft power dam.

DAM 250 ft high at Rampart site on Yukon River, near geographic center of Alaska, would create reservoir twenty times size of Lake Meade with annual power potential exceeding 12 billion kwhr.

tries projected for the rail belt. Initial installed powerplant capacity would be more than 100,000 kw. There is a distinct possibility that industrial demands for power would exceed the capacity of the project upon completion of the dam and powerplant, even if construction were undertaken immediately.

In Southeastern Alaska the principal markets for new low-cost power sources appear to be the potential paper pulp industry, and mining or related developments. The States consume each year nearly two billion dollars worth of paper products, necessitating the importation of huge quantities of paper and pulp. During any period of sustained high industrial production, however, imports are insufficient to meet the demand. The shortage could be greatly alleviated by development of a paper pulp industry in Alaska. From the dense hemlock, spruce and cedar forests of Southeastern Alaska one billion board feet annually could be harvested in perpetuity. Conversion of hemlock and spruce into newsprint would increase the supply of newsprint available for the States by 25 percent. Low-cost hydroelectric power would be developed near each of the pulp plant sites. There are 30 major potential hydroelectric power sites in Southeastern Alaska having an aggregate continuous capacity of more than 300,000 kw. Investigations are now being conducted on those major sites near Juneau, Sitka and Ketchikan. The Forest Service has entered into a contract with private interests by which certain timber in the Tongass National Forest may be cut for utilization in a pulp mill to be built near Ketchikan.

Rampart Reservoir Has Great Potentialities

Two potential Alaskan projects are so large as to command special interest. The largest potential power development in Alaska would require a dam on the Yukon River near Rampart, while the second largest would involve a diversion from the headwaters of the same river.

The Yukon is one of the great rivers of North America, ranking fifth in length and basin area. Heading in British Columbia, within 30 miles of the North Pacific Ocean, it flows northwest 900 miles to enter Alaska with a flow of about 50 million acre-ft collected from 120,000 sq miles. It crosses and recrosses the Arctic Circle near Fort Yukon, veers to the southwest and discharges into the Bering Sea after having traversed another 1,400 miles and fallen 879 ft in its course across Alaska. Although the flow at the river mouth is unmeasured, the discharge in 1900 was estimated as being two-thirds that of the Mississippi River. To measure the actual flow, two permanent gaging stations will be installed during the summer of 1949.

The Rampart site, which may prove to have the greatest potentiality in North America, is on the Yukon River near the geographic center of Alaska. A dam 250 ft high would enable the firm generation of more than 12 billion kwhr annually. The reservoir created by such a dam would inundate what is known as the "Yukon Flat," a valley 40 to 100 miles wide and 200 miles long. The river, 2 to 20 miles wide in this stretch, has many new and old channels with innumerable islands and a gradient of 2 ft or less per mile. At the lower end of the valley the Yukon Flat suddenly narrows and ends at the head of a constricted section where canyon walls hug the river, giving rise to the name of Ramparts.

A dam in the Ramparts would block the mouth of the Yukon Flat, making a vast reservoir of the area. In contrast to the Columbia River, which has scarcely enough storage sites for complete regulation, the Yukon Flat is such a large potential reservoir that the long period of years required to fill a reservoir of such fantastic capacity would actually limit the height of the dam. Based on inadequate reconnaissance data, it would appear that a reservoir created by a dam only 250 ft high would be approaching the upper limits of reasonable storage capacity. Although ice in the reservoir would pre-

(*Continued on page 87*)

FLOODS ARE PROBLEM in Alaska. Fairbanks, Alaska, suffers flooding from overflowing Chena River, tributary of Tanana, which flows into Yukon.

Engineers' Notebook

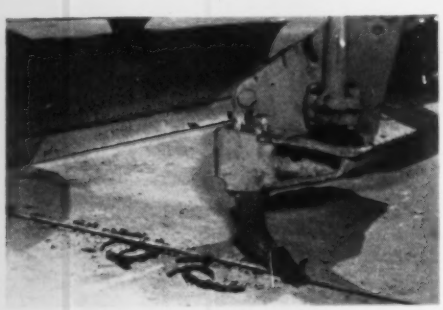
Adapting Equipment to Special Tools Cuts Cost of Resealing Airport Pavement

WILLIAM R. WALLIS, Assoc. M. ASCE
Civil Engineer, Inglewood, Calif.

SHORTAGE OF MATERIALS and lack of manpower and equipment were major obstacles confronting post engineers charged with the responsibility of maintaining airfields used by our flying forces during the war. These same obstacles faced private contractors, with the result that only a few high bids were received whenever efforts were made to contract major maintenance work.

The Post Engineer at Hendricks Field, Sebring, Fla., was confronted with the problem of removing, cleaning and resealing approximately 820,000 lin ft of expansion joints in concrete runways, aprons and taxiways. It was found necessary to reseal these joints because the existing joint filler was performing unsatisfactorily. The expected period of Army use and the deteriorating effects of leakage into the base and subgrade affected the decision to completely replace the joint filler.

Bids were asked from various contractors throughout the states. One lone bid resulted, with a figure of 16 cents per ft for furnishing the material and executing the work. Even this contractor showed a decided indifference to the project, which might have been from a lack of knowledge of such work or from an overabundance of other jobs. As it was believed that the bid was far in excess of a reasonable price, it was decided to do the work as a Post Engineer activity.



REGULATION TOOTH from scarifier attachment of road patrol unit is adapted for use in cleaning out joints to be resealed. Tooth was drawn out in blacksmith shop to shape that would fit joints.

Tools Made to Fit Job

The equipment used consisted of a road patrol, a 300-gal asphalt distributor, an air-compressor truck, one self-fired crack-sealing pot, four patching pots and a sweeper. The crew assigned to the project consisted of five common laborers, two heavy equipment operators and a foreman.

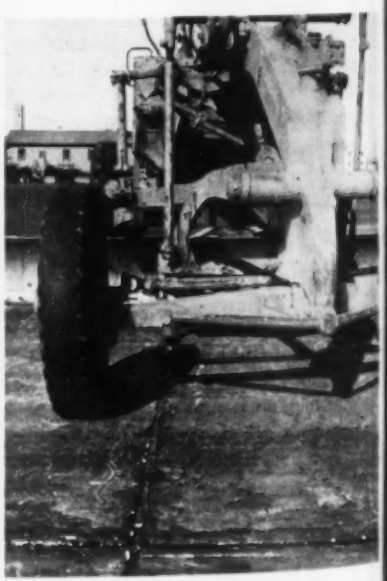
A regulation tooth from the scarifier attachment of the road patrol was drawn out in the blacksmith shop to a shape that would fit the joints to be resealed. The air compressor truck was equipped with an air hose extended to the driver's side of the truck, and so arranged that the driver could operate or maneuver the air nozzle. Standard patch pots were converted into pouring pots by sealing the wide, flat mouth with a piece of sheet metal, perforated at the center to allow for a 6-in. length of $^1/_4$-in. pipe, which was soldered to the sheet metal.

Joint sealing operations were coordinated with flying needs by shifting equipment and materials from day to day and moving them into safety areas each night. The asphalt was made ready for use each morning before the full crew arrived. Asphalt was heated to a temperature of 350 deg F, the temperature which experience showed to be the most satisfactory for pouring.

The specially shaped scarifier tooth was lowered from the road patrol into the joint, the blade dropped, and the patrol driven at a normal rate of speed, thus plowing out the joint and removing the old sealing compound with the blade in one operation (see accompanying photographs). The air compressor truck followed, its air nozzle being used to blow all loose particles from the joint, thus cleaning it for pouring of the new seal. Three or four laborers using the pouring pots, and drawing from the self-fired crack-sealing pot, were able to pour a clean and uniform joint and maintain the pace set by the road-patrol operator. After allowing sufficient time for the asphalt to cool and properly set, the sweeper operator cleaned the entire area with his machine.

Progress and Costs Prove Advantageous

The average rate of progress for an eight-hour day was 12,000 lin ft of joint. The average amount of asphalt used per day was 3,120 lb. Workmen were paid the prevailing wage rate.



ROAD PATROL PROCEEDS at normal speed with reshaped scarifier tooth lowered into joint and blade dropped. Thus tooth plows out joint while blade removes old sealing compound in one operation.

Itemized costs per day were as follows:

Penetration asphalt (60–70), 3,120 lb @ $30 per ton		$46.80
Labor:		
5 common laborers, 40 hours @ $0.71	$28.40	
2 equipment operators, 16 hours @ 1.19	19.04	
1 foreman, 8 hours @ $1.38	11.04	58.48
Equipment, including depreciation		30.00
Total cost per day		$135.28

Approximately 69 working days were required to complete the job, making the total cost $9,300 as against a bid cost of $131,000.

The itemized costs, per lineal ft of joint, were as follows:

Material	$0.0039
Labor	0.0049
Equipment and depreciation	0.0025
Total	$0.0113

Planning and execution of the work were accomplished by J. H. Pellum, Supervisor of Roads and Runway Maintenance; J. Brink Cotton, Head of the Engineering Branch; and the writer as Post Engineer.

New Loading Advocated for Highway Bridges

T. Y. LIN, Assoc. M. ASCE

Assistant Professor of Civil Engineering, University of California, Berkeley, Calif.

STRUCTURAL ENGINEERS usually face three major problems in design—the properties of the materials employed, the stresses and strains expected, and the forces acting on structures. Considering the volume of technical research devoted to the first two items, the problem of forces acting on structures—the primary issue among these three design factors—seems to have been seriously neglected. Under the auspices of the Committee on Forces Acting on Structures (Stewart Mitchell, chairman) of the ASCE Structural Division, an attempt has been made to tackle this problem, narrowing it down to one type of structure—highway bridges—and further confining the study to live loading.

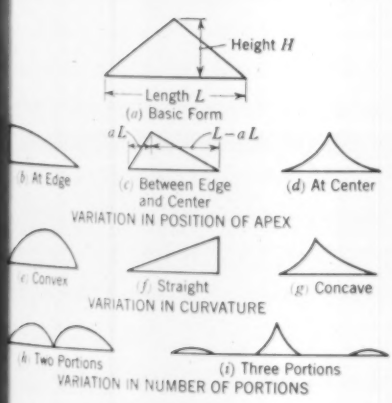


FIG. 1. ALL INFLUENCE LINES can be considered as variations of basic triangular form (top). Influence lines are used in study of highway bridge loadings because stresses at any point of any bridge resulting from any system of live loads can be compared by their use.

Weight of Vehicles Has Increased

The rapid evolution of highway trucks, with trailers and semitrailers attached, has imposed upon bridges a heavy burden beyond the expectation of bridge engineers. That the present design loadings are consistent neither with actual vehicles nor with safety and economy is recognized by many. Bridges are designed for certain hypothetical loadings coupled with low allowable stresses. They serve our present heavy vehicles by virtue of the safety margin provided in the allowable stresses, but both the loads on, and the stresses in, the bridges differ materially from those contemplated in design. Fortunately the bridges are still safe in general; unfortunately their factors of safety are divergent, varying not only for different spans but also for different parts of any one span, a situation mentioned by Stewart Mitchell, M. ASCE, in "A More Logical Loading for Highway Bridges" (CIVIL ENGINEERING for May 1945). To obtain a uniform factor of safety not only must the weight of actual vehicles be used for the design loading but also the expected actual stresses must be taken as the allowable ones.

Present Design Loadings Are Inadequate

Much credit should be given for the adoption of H loadings and their painstaking development up to the present H-S-44 loadings. During their development, however, many compromises have been made which impair their effectiveness. Some inadequacies and inconsistencies of the present design loadings are as follows:

1. Discrepancy with actual vehicles
2. Variation from legal limits
3. Only one H-S truck on loaded lengths sometimes up to 145 ft
4. Necessity of applying both the truck and the lane loadings to obtain maximum stresses
5. Insufficient provision for continuous spans
6. Too many classes of loadings

Influence Lines and Loading Diagrams Used

Influence lines and loading diagrams are the tools of this study. Influence lines are used because stresses at any point of any bridge resulting from any system of live loads can be compared by their use. Instead of dealing with all sorts of stresses at different points of different bridges, it is necessary only to deal with different forms of influence lines.

All influence lines can be considered as variations of a basic triangular form (Fig. 1), the variations occurring in the following elements of the influence line: length, height of apex, position of apex, form of curvature, number of portions and other minor elements. The most important is of course the variation in length; next in importance comes the number of portions and the position of the apex. When considering the relative effects

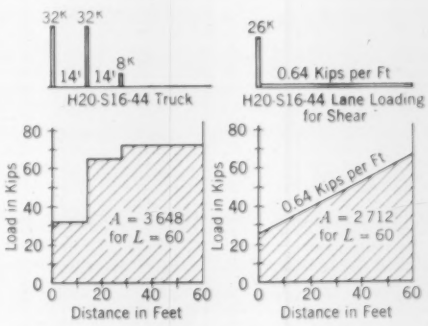


FIG. 2. RELATIVE EFFECTS of loads on stresses may be judged by loading diagrams. Loads appear above and loading diagrams below.

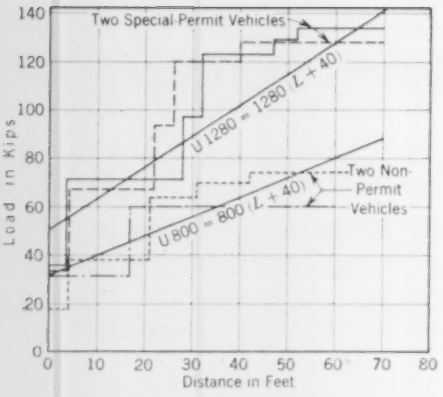


FIG. 3. LOADING DIAGRAMS for two non-permit vehicles and two special-permit vehicles are plotted for comparison with proposed envelope loadings of U800 for non-permit type and U1280 for special-permit type. Proposed loadings are based on influence lines in form of right triangle *(f)* in Fig. 1.

of vehicular loads on stresses, the variation in height of apex does not enter into the problem, while the variation in form of curvature and other minor variations are of relatively little significance.

Loading Diagram for Vehicle Constructed

A loading diagram for a vehicle, in its primary form, is similar to a shear diagram for a cantilever beam loaded with that vehicle. This diagram is constructed by plotting axle spacings, sometimes with modifications, along the X-axis and the total axle loads along the Y-axis. For example, the H20-S16-44 truck and its lane loading for shear would be separately represented as in Fig. 2, for straight influence lines with the apex at the edge. For an influence line of length L, the area under the loading diagram up to L will represent to some scale the maximum stress produced by that loading, provided that the correct axle is placed at the apex.

Relative effects of loads on stresses may be judged by a comparison of the areas under the loading diagrams. For example, in Fig. 2, the ratio of stresses produced by the H20-S16-44 truck and its lane loading for shear on a length of $L = 60$ ft is the ratio of the two shaded areas, that is, 3,648 2,712 = 1.34 for that particular form of influence line.

When the apex of the influence line is not at the edge, the distances of the axles to the right and left of the apex must be modified by the corresponding ratios $1/(1-a)$ and $1/a$, Fig. 1. Other modifications are necessary when applying loading diagrams to curved influence lines, but these are not presented here.

Actual Vehicles Studied

Present highway vehicles can be divided into two groups:

1. Non-permit vehicles, that is, vehicles with weights within or near the legal limit which are allowed to use the highways without a special permit.
2. Special-permit vehicles, that is, vehicles over the legal limit which are allowed to operate on the highways under special permits.

With data obtained from the Public Roads Administration and some state highway departments, typical maximum vehicles representing these two groups have been chosen and their effects on different forms of influence lines have been studied by plotting their loading diagrams. For example, Fig. 3 shows loading diagrams for two non-permit and two special-permit vehicles. One approximate envelope loading diagram is drawn for each group of vehicles. These envelopes are drawn such that the total area under the envelope for any value of L should approximate the maximum total area under any vehicle for the same value of L. A loading diagram for $W = 800\ (L + 40)$, representing a uniform load of 800 lb per ft plus a concentrated load of 32,000 lb, forms an approximate envelope for the non-permit vehicles; whereas a loading diagram for $W = 1{,}280\ (L+40)$, a 60-percent increase over the above, forms an approximate envelope for the special-permit vehicles. These two envelopes will be termed the U800 and the U1280 loadings respectively.

New Design Loading Proposed

The envelope loadings are the actual loadings, because they produce the maximum effects of actual vehicles on stresses. Hence it is proposed that the U800 loading be adopted as the standard loading for highway bridges, while the U1280 loading representing the special-permit vehicles should also be taken care of by providing an overloading factor of safety for the U800 bridges.

Present legal limits are generally either of the straight-line form, $W = K\ (L+40)$, with K varying from 600 to 850, or of the parabolic form, $W = 1{,}025\ (L+24) - 3L^2$, with a minimum of 32,000 lb, as recently proposed by the AASHO. The proposed U800 loading is identical with the legal limit of $W = 800\ (L+40)$ and is very close to the AASHO legal limit. Loading diagrams for a succession of trucks are given in Fig. 4. The AASHO legal loads spaced at 35 ft

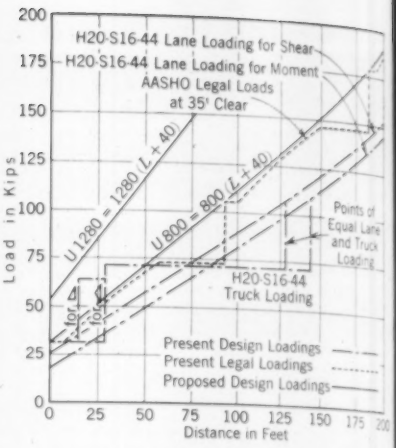


FIG. 4. VISUAL COMPARISON of various loadings is afforded by loading diagrams for present design loadings, present legal loadings, and proposed design loadings of U800 and U1280.

clear, which probably is representative of actual maximum conditions, are closely approximated by the proposed U800 loading.

Proposals to Secure Uniform Factor of Safety

To secure a uniform factor of safety and simultaneously to take care of special-permit loads, it is proposed that:

1. All present allowable stresses be increased 50 percent.
2. For all U-loading bridges, live-load stresses should not be calculated for the nominal loading, but instead should be calculated for a loading 60 percent greater than the nominal design loading (for example, U1280 for U800) when considering lateral and longitudinal forces.
3. All live-load stresses be further calculated for a loading 100 percent greater than the nominal design loading (for example, U1600 for U800) when not considering lateral and longitudinal forces.

For influence lines of more than one portion, it should be further specified that "One or two additional concentrated loads not greater than the first and spaced so as not to exceed the limit of $W = 800\ (L+40)$ should be placed at the apexes of the second and third major portions of the influence line."

The adoption of this proposed actual loading coupled with the actual stresses will produce an increase in the over-all loading capacity of bridges together with a simultaneous saving of material. This is possible because of a more uniform factor of safety resulting in a better distribution of material.

Acknowledgement is made to Stewart Mitchell, under whose direction this article was prepared.

...THE READERS Write

Consultant Reviews Part in Penn-Lincoln Parkway Design

To the Editor: Various aspects of the planning, design, and construction of the Penn-Lincoln Parkway East were discussed in four articles in the December 1948 issue. I am sure that there was no intent on the part of the authors or CIVIL ENGINEERING to omit mention of the firm of Michael Baker, Jr., Inc., and the important part which it performed in the design of the Penn-Lincoln Parkway East.

On November 29, 1943, after over 20 years of preliminary planning and reconnaissance work as performed by E. L. Schmidt, now chief engineer of the Pennsylvania Department of Highways, and other Pittsburgh engineers, the Hon. John C. Shroyer, then secretary of the Pennsylvania Department of Highways, and the Hon. Ray F. Smock, then assistant secretary and now secretary of the Pennsylvania Department of Highways, engaged our firm to make detailed surveys and prepare detailed plans and specifications for the Penn-Lincoln Parkway East.

At the time of the signing of this contract George S. Richardson, consulting structural engineer of Pittsburgh, Pa., had agreed with our firm to associate under this contract for the design of the major structures. All field surveys required were obtained by the prime contracting engineering firm and furnished to Mr. Richardson, who designed in detail all the plans and specifications for the major structures in the contract.

Shortly after the signing of the contract, Ole Singstad, consulting engineer and tunnel expert of New York City, consented to act as consulting engineer to our firm on the tunnel design, which was performed in the Pittsburgh office of the firm under the direction of Wayne D. Meyers, project engineer, directly assisted by James Rooney, tunnel engineer, and a staff under his direction set aside specifically for the tunnel design. Mr. Rooney is now chief tunnel engineer for the Public Roads Administration in Washington, D.C. Mr. Singstad acted as consultant throughout the design and reviewed all plans and specifications during their preparation and prior to their submission to the Commonwealth of Pennsylvania's Department of Highways.

During the performance of this contract the Commonwealth of Pennsylvania's Department of Highways was represented by E. L. Schmidt, who was then district engineer of the Department of Highways at Pittsburgh, and it was therefore under his direction and supervision that our contract was completed.

The current estimated cost of construction of the project is approximately $50,000,000. Of this amount about $19,000,000 is estimated to be the cost of the Squirrel Hill Tunnel designed by our Pittsburgh office with Mr. Singstad as our consultant, and approximately $14,000,000 of major structures as designed by Mr. Richardson. The remainder represented interchanges and four- and six-lane superhighways and other miscellaneous items designed by our Pittsburgh office.

In 1947, following the completion of the engineering design of the parkway, the Commonwealth of Pennsylvania's Department of Highways engaged Mr. Richardson as consulting engineer to make studies of adequate interchanges for the terminus of the parkway in the downtown triangle. It is my understanding that he was also engaged by the Pennsylvania Department of Highways to prepare detailed plans and specifications covering portions of this work, including the Point Bridge Interchange. This work in itself was a major project and is composed primarily of structures.

Following the conclusion of our contract, it is my understanding that in 1947 the Commonwealth of Pennsylvania's Department of Highways engaged Mr. Singstad as their consultant during the construction of the Squirrel Hill Tunnel. At that time a new lighting system had been invented by Mr. Singstad and his electrical engineer, Leo Geenens, after twelve years of experimentation and the helpful cooperation of Westinghouse Electric Corp. and General Electric Co., which was not available during the time of our previous design. It is further my understanding that Mr. Singstad found this system to be an improvement over that previously included in the design and recommended to the Pennsylvania Department of Highways that the plans be changed to provide for the new system.

Without the association of Mr. Richardson on structures and Mr. Singstad as consultant on tunnels, the performance of our Penn-Lincoln Parkway East contract would have been much more difficult. It was Michael Baker, Jr.'s, first major contract in highway design. Likewise, the many years of experience of Mr. Schmidt and the years of study which he had performed in the planning and location of the Penn-Lincoln Parkway East, and his guidance and supervision throughout the performance of our contract, were most helpful. The successful completion of our share of the work on the Penn-Lincoln Parkway East was also brought about by our firm through the very excellent administration of Mr. Meyers and a very competent staff of highway engineers and designers which he gathered around him under our firm. A number of the 500 men of our organization currently scattered throughout the Western Hemisphere had the pleasure and opportunity of working on some phase of the design of the Penn-Lincoln Parkway East.

MICHAEL BAKER, JR., M. ASCE
President, Michael Baker, Jr., Inc.
Rochester, Pa.

Westinghouse, Podolsko Bridge Costs Compared

Dear Sir: The George Westinghouse Bridge, referred to by Mr. Polivka in his article on the Podolsko Bridge in the January issue, was constructed by the Department of Public Works of Allegheny County, Pennsylvania, and designed under my supervision. The total cost of the bridge, as shown by final payments to contractors, was about $1,543,000, which includes about $92,000 for granite pylons serving no purpose other than a decorative one. Mr. Polivka has used the sum of $3,606,000 as the cost of this bridge, which I believe to be about the cost of the whole Westinghouse Bridge project. At the time the bridge was built, 3.44 miles of the existing Lincoln Highway were relocated and the approach work included some very heavy cuts and fills and other structures in addition to the bridge. This part of the work was done by the Pennsylvania Department of Highways and I do not have the cost figures for it.

It is to be noted that if the actual cost of the bridge is used, the cost per square foot amounts to about $18.00, and if the

cost excluding the pylons is used, the per-foot cost is reduced to about $17.00. Mr. Polivka's figures are $42.25 per sq ft for the Westinghouse Bridge and $27.00 per sq ft for the Podolsko Bridge.

There are some other factors which should be taken into account in any such comparison. It would appear from the sketch of the Podolsko Bridge shown in Fig. 1, that all foundations are relatively shallow, thus making short approach spans feasible and economical. On the other hand, the foundations for the Westinghouse Bridge are quite deep. One of the main piers is founded more than 80 ft below the ground surface. Because of foundation conditions and the location of the railroad yards, Turtle Creek, and other features, all the spans are of necessity fairly long. The average clear span length of the Westinghouse Bridge is about 275 ft as compared to 162 ft for the Podolsko Bridge. Under such circumstances it would be anticipated that the cost of the bridge with the longer spans would exceed that of the bridge with the shorter spans.

A considerable amount of detailed information in regard to the Westinghouse Bridge appeared in two articles in the June 1932 issue of the *Journal of the Concrete Institute*. In this article the cost, not including pylons, is given as $1,480,000. At that time the contract work was not entirely completed and the final contract payments were not known.

American design and construction methods have always produced structures at costs comparing favorably with those of any other country.

GEORGE S. RICHARDSON, M. ASCE
Consulting Engineer
Pittsburgh, Pa.

DEAR SIR: I have read with interest the comments of Mr. Richardson on the comparative cost figures for the Podolsko and Westinghouse bridges, the latter designed under his supervision 18 years ago. He and his assistants are to be congratulated on this outstanding accomplishment in the field of modern concrete bridges. The main purpose of my article was to encourage American bridge engineers to make this country as unsurpassed in the field of concrete arches as it already is in the field of steel bridges. His eminence in this field, as the designer of the longest concrete span in the United States, is evident.

Although the actual cost per square foot of the Podolsko Bridge was $9.75 (in American dollars), I increased this price to $27 for comparison with costs in the United States today. Labor and materials at the present time in Czechoslovakia have increased exactly in proportion to the exchange value ($1 = 50 Crowns).

In the same way I proceeded with the cost of the Westinghouse Bridge on the basis of the *Engineering News-Record* Construction and Building Cost Indexes of May 27, 1948. The index for 1930, 1931, and 1932 averages 200 (Index for 1913 = 100). For 1948 I took the index 480, making the comparative cost of the Westinghouse Bridge $1,502,500 × 2.4 = $3,606,000, or $42.25 per sq ft, as given in my article in CIVIL ENGINEERING for January 1949.

It may be of interest that the costs of the world's two longest spans are $5.65 for the Sandoe Bridge and $9.50 for the Esla Bridge, as compared with $9.75 per sq ft for the Podolsko Bridge.

Naturally these are approximate figures. The cost of the Podolsko Bridge of 14 million crowns includes relocation of the highway and the approach work.

J. J. POLIVKA, M. ASCE
Consulting Engineer
Berkeley, Calif.

Current Opportunities in Highway Engineering Noted

TO THE EDITOR: The vast highway program getting under way throughout the country presents a great opportunity to establish highway engineering as a vital and integral part of the engineering profession. Highway engineers can now put to practical use a great fund of knowledge and "know-how" backed by many years of experience and research. Much of this technical knowledge and "know-how" has been gained through the actual experience of road building, through experimental research projects carried on in the field, and through studies of performance records of existing roads that have been subjected to increasing traffic demands.

In the past, roads that were built to the accepted standards of the time and in accordance with the best known practices compatible with varying local conditions of soil and available construction materials, often proved inadequate because of ever-increasing volumes of traffic and ever-increasing truck and bus loads. In every agreement between a state or subdivision and the federal government for a highway project upon which there is to be federal aid, the state or subdivision must agree to provide for adequate maintenance of the project from the time the construction work is completed. Similarly, counties must agree to provide for the maintenance of highway projects to which state aid has been given. Consequently the burden and responsibility for keeping roads in condition to meet increasing traffic demands has been placed upon the maintenance departments, and it is understandable that maintenance and reconstruction costs have been high.

In the course of the growth and development of highway engineering, then, it has been possible in large measure to shift the responsibility for the successful performance of our highways to the maintenance departments. And much of the blame for roadway failures and high costs of reconstruction and maintenance, particularly those chargeable to "heavy" or "extraordinary" maintenance, has ultimately been placed upon the increasing demands of truck and bus traffic. This has been justified on the basis that increased load intensities and greater volumes of traffic have caused failures and high maintenance costs on roads that were originally built for lighter traffic.

However, any carry-over of this philosophy into the present highway program may seriously affect the results. Any responsibility that truck and bus traffic had in the past for the preservation of our public roads, ended when legal restrictions were placed upon the weights and dimensions of the loads that could be carried on the roads. These restrictions in turn, have made it possible for the engineer to approach the problems of highway design on a rational basis.

It remains, then, for the highway engineer to accept the challenge of designing and building highways that will give satisfactory service to present and foreseeable future traffic demands, in accordance with established legal load limits and proper safety factors, as the structural engineer has done in the design and building of highway bridges. Acceptance of full responsibility by highway engineering forces in this respect will assure their receiving credit for the successful performance of our public roads in the road building program that is now getting under way. And the consequent reduction in maintenance costs will leave more funds for construction and for higher engineering salaries.

Much can be done to instill in students and new employees in highway engineering a sense of obligation to the public in the design and building of our public roads, by stressing the need for adequate design and the need for close attention to details in the control and inspection of construction operations.

MARTIN EKSE
Asst. Prof., Civ. Eng.
Univ. of Washington
Seattle, Wash.

SOCIETY NEWS

Mexico City Sets Stage for Summer Convention

A HAPPY COMBINATION of an unusual and informative technical program with unlimited opportunity for travel in the country of a friendly neighbor awaits the host of ASCE members planning to attend the Summer Convention in Mexico City. Dates of this meeting are July 13–15. As expressed by President Franklin Thomas in his Annual Meeting address, this international convention "will be an event of great significance" in bringing about new understandings and cementing inter-American friendships.

Mexico Offers New Adventures

To the traveler, whether by air, rail or motor, Mexico offers warm hospitality. All forms of travel to Mexico's capital are comfortable, and provide scenery and experiences unrivaled. Several special arrangements are being planned to bring members to this ASCE Convention.

For those traveling to Mexico City by rail from the West Coast, a special train is being made up in Los Angeles, with connections at San Francisco, Tucson and way points. Local Sections along the route are cooperating in arrangement of dates to suit the convenience of travelers. Inquiries may be addressed to Ray L. Derby, Department of Water and Power, City of Los Angeles, Box 3669 Terminal Annex, Los Angeles 54, Calif.

Travel by rail from other points in the United States can be arranged quickly and easily by a call to the nearest passenger agent. So many lines have special trains that space here does not permit full description. Preliminary arrangements have been made for a special car to the Convention from St. Louis. Details will be available at a later date.

A cavalcade of motorists from throughout the central portion of the United States will meet in San Antonio, Tex., to enjoy the excellent Mexican highways and scenery together. Full details of this tour may be obtained by inquiry to W. H. Furlong, U.S. representative of the National Highway Direction, Republic of Mexico, 525 Bedell Bldg., San Antonio 5, Tex.

For those whose pressure of business does not allow a leisurely trip, several airlines operate through flights to Mexico City. From any point in the United States it is only a one-day trip to the Convention city. Schedules of special flights are available at all airline terminals. It should be remembered that special concessions on fares are made on mid-week days for passengers accompanied by their families.

Ultra-Modern Hotel Headquarters

Major events of the Summer Convention will be held at the Hotel Del Prado, which will be headquarters for visitors. This luxurious new hostelry offers every type of accommodation and service. Located in the center of the city, the hotel has a roof garden and solarium and a gallery of fine arts for enjoyment during leisure hours. It will be wise to make requests for reservations early. Inquiries and requests should be addressed to Sr. Antonio Perez O., Manager, Hotel Del Prado, Mexico, D. F. Attendance at the ASCE Convention should be mentioned.

Five Divisions Plan Programs

Participation by engineers from both sides of the border in technical programs is planned by the five Divisions scheduling sessions. The water resources of Mexico and their control will be the subject of several sessions. Others will be devoted to meetings of the Soil Mechanics, Construction, Power, and Highway Divisions. These technical sessions will occupy the first two meeting days—Wednesday and Thursday, July 13 and 14. A full program of all events will be published in the June issue of CIVIL ENGINEERING.

Excursions and Side Trips

Points of both technical and scenic interest will be visited in specially arranged tours. In addition, the opportunities for side trips and extended tours are almost unlimited. Many will be attracted by the thought of the drive down the Inter-American Highway or spending a few carefree days in Acapulco on the Pacific Coast. Excellent descriptive material on side trips is available

HOTEL DEL PRADO, ULTRA-MODERN NEW STRUCTURE, in heart of city (shown below), will be headquarters of ASCE Summer Convention in Mexico City. This view was taken from Alameda Park. Typical Mexico City street scene is pictured at right.

from several sources. Among these are the Mexican Consulate in your area; the Mexican Government Tourist Bureau, 630 Fifth Avenue, New York, N. Y.; or Mr. William H. Furlong, U. S. Representative of the National Highway Direction, Republic of Mexico, whose address is 525 Bedell Bldg., San Antonio 5, Tex. Copies of a bulletin of motoring information are available at ASCE Headquarters.

In and near the Convention city are such points of interest as the Chapultepec Palace and Park, the Flower Markets, Guadalupe and the Pyramids of the Sun and Moon, the Floating Gardens of Xochimilco and the snow-capped peak of Popocatepetl and Ixtaccihuatl. Entertainment ranges from symphony concerts to bull fights, with night life for those whose days do not contain enough hours.

Tourist Cards Required

For travelers to Mexico there is the requirement of a Mexican tourist card, which may be obtained with ease. A special application form, available on request to ASCE, 33 West 39th St., New York 18, N. Y., will simplify the procedure. Before the tourist card will be granted by the Mexican government, proof of citizenship must be presented. This proof may be a photostat of a birth certificate or a voting certificate. It will be returned to visitors with their travel card by the Mexican government.

For return to the United States, this proof of U. S. citizenship will be needed.

Annual Convention—Mexico City
Dates—July 13–15, 1949
Hotel Del Prado, Mexico, D.F.

Fall Meeting—Washington, D.C.
Dates—November 2–4, 1949
Hotel Statler, Washington, D.C.

Therefore, members should carry these two documents with them on their trip. In addition, upon return to the United States, visitors will be required to give evidence of recent smallpox vaccination. The U.S. Public Health Service requires a certificate showing vaccination within a period of three years prior to reentry. If this is not presented, the traveler will be placed in quarantine for two weeks.

Pesos Exchanged for Dollars

The monetary unit of Mexico is the peso, which has a varying exchange rate. At present the rate is unusually high, about seven to the dollar. This means that at present the dollar will purchase more Mexican merchandise than is customarily the case. Money may be exchanged at any point of entry or at the headquarters hotel. Returning visitors are allowed to bring home merchandise not to exceed the value of $100, free of U.S. import duty. For tourists remaining in Mexico longer than ten days, the the limit is raised to $400.

Climate Invigorating in Summer

Because of the altitude of Mexico City, about 7,000 ft, the climate in the middle of the summer is delightful. The days are clear and warm, the evenings invariably cool. Casual comments to natives will bring a response in English, for, although Spanish is the official language of Mexico, English is used widely. It is not essential to know Spanish unless travelers plan to do some exploring. Most visitors enjoy the attempt to use their Spanish, while the Mexicans good naturedly enter into the game.

Engineers of Two Nations Make Plans

Emphasizing the international character of this ASCE Summer Convention in Mexico City, engineers of two nations are working on arrangements. Heading a large committee of our hosts in Mexico is Ing. Augustin M. Valdes, Assoc. M. ASCE, who resides in Mexico City.

The general committee on arrangements is headed by Charles M. Upham, M. ASCE, engineer director of the American Road Builders Association, Washington, D. C., and consists of the following: R. B. Brooks, of St. Louis; George D. Camp, of Mexico City; Adelbert Diefendorf, of Salt Lake City; Gibb Gilchrist, of College Station, Tex.; Ernest E. Howard, of Kansas City; L. M. Lawson, of El Paso, Tex.; and A. M. Rawn, of Los Angeles.

Cooperating with ASCE will be the Associacion de Ingenieros y Arquitectos de Mexico.

Construction Subjects Prominent on Spring Meeting Program

PAPERS ON THE construction of offshore drilling platforms and other phases of the oil industry will comprise one of two sessions of the Construction Division, scheduled to meet during the ASCE Spring Meeting in Oklahoma City, April 20–22. Other construction projects of special local interest, ranging from Fort Gibson Dam to the Oklahoma City sewage treatment plants, will be treated in a joint session with the Sanitary Engineering Division.

Continuing the construction theme in the social program, the Thursday luncheon, "dedicated to the construction industry," will feature an address by Adolph Teichert, newly elected president of the Associated General Contractors of America.

Nine Technical Divisions to Meet

In addition to the Construction and Sanitary Engineering meetings, there will be sessions of seven other Technical Divisions—Hydraulics, City Planning, Structural, Highway, Air Transport, Soil Mechanics and Foundations, and Surveying and Mapping. The latter Division is scheduling a paper of special local significance on requirements of cadastral maps for the oil industry. Another paper dealing with the development of the Oklahoma City Civic Center will head the City Planning Division session. The various Division meetings will be abstracted in the May issue of CIVIL ENGINEERING.

Inspection Trips Planned

Opportunities to inspect the water filtration and sewage treatment plants, the local air depot, and numerous projects under construction throughout the city will be afforded in a series of tours on Friday. Another trip will give the Oklahoma City visitors a chance to see a rotary oil rig in operation.

Subjects of professional concern have not been neglected in planning the program. The Hon. Roy J. Turner, governor of the state, will comment on the relationship of the civil engineer to progress at the Wednesday morning general meeting, and Dr. Waldo E. Stephens, vice-president of the Stephens Petroleum Co. and former Columbia University faculty member, will give an address on "Some Implications of Effective Engineering" at the same session.

Other talks that look beyond technical horizons will be presented at the Friday joint luncheon with the Oklahoma City Chamber of Commerce. These include an address by Past-President R. E. Dougherty on the "Public Works Task Force Report to the Hoover Commission as It Affects Engineers," and an appraisal of "The Sanitary Engineer's Role in Making the World a Better Place in Which to Live," by Louis R. Howson, Chicago consultant.

Local Section and Student Chapter Conferences

Delegates from 16 Mid-Western Local Sections will participate in a Local Section Conference on Monday and Tuesday, April 18 and 19, preceding the general meeting. Others especially interested in Local Section activities may also attend.

A Student Chapter breakfast early

TYPICAL OF PRODUCTION EFFORT that won the war is this high-geared assembly line at Oklahoma City Douglas plant, where more than 5,000 C-47 Skytrains were turned out. At peak capacity plant had staff of over 15,000. Spring Meeting visitors will have opportunity to visit this plant.

Friday will be followed by an all-morning conference. The vocational outlook for engineering graduates will be reviewed by F. M. Dawson, dean of engineering at the University of Iowa, during the morning program.

Salary Plan for Government of Puerto Rico Advanced

ENGINEERING POSITION CLASSIFICATIONS are being studied under Society auspices at the request of the Director of Personnel for the government of Puerto Rico. This survey was begun in November of last year by Allen P. Richmond, of the Society's headquarters staff, as noted in the January issue. The Society's report is due in April.

The adequacy of the existing classification system with respect to engineering positions and the correctness of certain critical allocations to relative levels are being tested by application of the Job Evaluation Plan developed by the Southern California Aircraft Industries Committee. This plan utilizes ten factors which appear in varying degrees in all positions analyzed, plus a provision for supervision exercised.

The total score for a position is the sum of all weight values or "points" assigned to the appropriate step of each factor as found in that particular job, and is used to represent the relative level of the position. Similar methods are employed by many industrial organizations and are being used increasingly by public agencies as a logical, systematic solution to this difficult part of a salary plan.

Job analysts of the Insular Office of Personnel are being trained in the application of the SCAI system, but the responsibility for all findings and for the report will lie in the hands of the Society's representative.

Obituaries in "Civil Engineering" Replace Memoirs

ONE OF THE actions of the Board of Direction at its recent January meeting concerned a change in the manner of treating biographical notices of deceased members. The Board voted: "That the publication of memoirs in TRANSACTIONS be discontinued and short obituaries be published in CIVIL ENGINEERING."

This action is dictated by the continuing financial stringency in Society operation. It will have a number of immediate effects:

1. The forthcoming volume of ASCE TRANSACTIONS, Volume 114, for 1949 will not contain the list of printed memoirs, heretofore included and usually requiring about 10 percent of the volume.

2. Biographical notices received at Headquarters will form the basis of the short obituaries which will be publicized only in CIVIL ENGINEERING.

3. Memoirs already in preparation will be printed as previously in pamphlet form for distribution to family and friends, but will not go into TRANSACTIONS.

Friends of deceased members and officers of their Local Sections have in the past been most helpful and conscientious in completing these biographical records. This interest should continue, with emphasis on the shorter obituary form required for CIVIL ENGINEERING.

Recent Increase Noted in ASCE Women Members

IN THE TWO decades that have passed since 1927, when the Society admitted to corporate membership its first woman engineer, about 50 distaff engineering graduates have affiliated with the ASCE. The impetus given to technological education for women by the war is reflected in the fact that the Society's present enrollment of 43 women engineers has been gained almost entirely since 1940.

As might be expected, a number of these women engineers are using their specialized abilities in such federal government agencies as the Bureau of Reclamation, the Mississippi River Commission, the Atomic Energy Commission and the U.S. Coast and Geodetic Survey. One is project engineer and mathematician for the Naval Bureau of Ordnance, another with the American Military Government in Berlin, and two are hydraulic engineers for the Army Corps of Engineers. Four are employed by state highway or public works departments, two in municipal engineering work, and one is making good as a county surveyor.

In the field of private employment, at least a dozen members are working as draftsmen or engineering assistants in consulting offices or for industrial engineering organizations and two are engaged in university teaching. Elsie Eaves, Assoc. M. ASCE, is manager of the business news department and director of market surveys for several McGraw-Hill publications.

Student Chapter Group to Aid Employment Program

AN ALL-OUT CAMPAIGN to help civil engineering students in the New York area obtain summer employment in the civil engineering field has been launched by the executive committee of the Metropolitan Conference of Student Chapters. The eight schools comprising the conference include Columbia, New York, and Rutgers universities, the College of the City of New York, Cooper Union, Newark College of Engineering, the Polytechnic Institute of Brooklyn, and Manhattan College.

Cooperation is being sought from civil engineering firms, railroads, contractors, and public service departments in an attempt to place engineering students in positions during the months of June to September, inclusive.

Those interested in assisting the committee in its worthwhile work should write to William Mulder, c/o Newark College of Engineering, Department of Civil Engineering, Newark, N.J., or William Koff, c/o Columbia University, Department of Civil Engineering, New York City.

ASCE Secretary Recommends Engineers to Bonding Businesses

A DELIBERATE PROGRAM of cooperation between surety bonding companies and the engineering and architectural professions was advocated by ASCE Executive Secretary William N. Carey, in an address before the National Association of Surety Bond Producers at their recent annual meeting in New York. "Engineers and architects on private work now look twice at the cost of performance bonds before writing a specification requiring them," the speaker told the Association.

Serious consideration was recommended for employing qualified energetic civil engineers in selling, underwriting, investigations and research in the bonding business, which Colonel Carey believes would be helpful to the business of corporate suretyship and provide a medium for better understanding and cooperation between that business and the engineering and architecture fraternity.

Members Honored at Union College Founder's Day Exercises

HONORARY DEGREES OF doctor of engineering were conferred upon two ASCE members—Shortridge Hardesty, who retired in January as Director and chairman of the Committee on Publications, and Carl B. Jansen—at recent Union College Founder's Day ceremonies in a program honoring Squire Whipple, Honorary Member of the Society and alumnus of the class of 1830.

A member of the New York consulting firm of Hardesty & Hanover, Mr. Hardesty was cited as "an outstanding representative of the high principles which Squire Whipple gave to the art of bridge building," and as "designing engineer for many of the nation's finest bridges." Mr. Jansen, president of the Dravo Corp., of Pittsburgh, was honored as the college's "outstanding living alumnus in the field of bridge building."

Originator of the Whipple truss and a pioneer in the bridge engineering field, Squire (his first name, not a title) Whipple was lauded in the three principal addresses of the day. His life at Union was described by Mortimer F. Sayre, professor of applied mechanics and director of the Union College Extension Division, and his contributions to American engineering were reviewed by Messrs. Hardesty and Jansen.

Discussing Squire Whipple as a bridge engineer in his address, Mr. Hardesty quoted a contemporary authority who referred to him as "'the retiring and modest mathematical instrument maker who, without precedent or example, evolved the scientific basis of bridge building in America, showed a rational method of computing bridge strains, and opened the eyes of the early builders to the scientific principles of their art.'

"Mr. Whipple's outstanding achievement, on which his fame rests, was the writing and publishing in 1847, at Utica, of *A Work on Bridge Building*, 'consisting of two essays, the one elementary and general, the other giving original plans, and practical details for iron and wooden bridges.' For an original work, this book is remarkable. The computation of stresses in bridge trusses, the design of members, and the determination of economic proportions even today require much time for mastery. It would therefore be expected that a pioneer in the subject would have a somewhat labored approach and only a partial conception of the possibilities and practical applications. His treatment could be expected to be somewhat incomplete, and crude in many respects.

"It is a tribute to the brilliance and thoroughness of Mr. Whipple's mental processes that none of these comments apply to his book. He shows a surprisingly complete grasp of the subject, and presents the calculation of stresses, for both fixed and moving loads, in a simple, direct, concise manner, employing short-cut processes that are logical and still useful. He gives a good column formula, and proportions members by correct methods. He makes quick comparisons of the relative weights of different truss framings by figuring for each type the stresses in all members, multiplying the stress in each member by its length, summing the products for each truss to get a total proportional to its weight, and comparing the totals for the different trusses. By the same process he investigates such problems as the economic panel length and the economic depth of trusses. He recognizes the approximations and limitations involved in such comparisons, also other considerations that should be taken into account.

"Mr. Whipple's book includes, in addition to the sections on stress calculations and economic comparison, drawings of typical details and members of iron and timber bridges and of complete timber trusses, and extensive notes regarding the strength of materials and the proportioning of members. These features are also logical and well worked out. Many of his details and designs are, of course, now obsolete, but they played an important part in the development of bridge construction.

"His other important contribution to the field of bridge engineering was the Whipple truss, which is described in his book. It had horizontal top and bottom chords, vertical posts, and diagonals extending over two panels, there being two practically independent web systems. While it was of the double-intersection type, the amount of indeterminateness was small. It was ideal for early long-span bridges, since the two-panel diagonals made possible the use of large truss depths with moderate panel lengths, without involving the use of steeply-inclined diagonals, which would have been uneconomic.

"Mr. Whipple continued to design bridges after the publication of the *Work on Bridge Building*. In 1852–1853 he constructed a Whipple truss bridge of 146-ft clear span upon the Rensselaer and Saratoga Railroad near West Troy, N.Y. It carried the steadily increasing weight of the rolling stock until 1882, when it was replaced by a new double-track bridge.

"In 1871 he was asked to prepare plans

PRESIDENT CARTER DAVIDSON, OF UNION COLLEGE (left in photo), confers honorary degrees of doctor of engineering upon ASCE Members Shortridge Hardesty (third from left) and Carl B. Jansen, (far right) in recent Founder's Day exercises. Dr. W. R. Whitney, of Union board of trustees, is shown between President Davidson and Dr. Hardesty.

for a bridge over the Erie Canal in Utica, N. Y., at a site where neither a swing span nor a high-level fixed span would be desirable. He developed for the location a vertical-lift bridge, which he patented in 1872. It consisted of a counterbalanced lifting floor suspended from an overhead fixed truss span. The bridge worked successfully, and was still in operation at the time of his death in 1888.

"After his election to honorary membership in ASCE in 1868, Mr. Whipple wrote frequently for PROCEEDINGS."

Speaking on "The Future of Bridge Building," Mr. Jansen reviewed the rapidly expanding program of bridge building already in the making at the time of Squire Whipple's death, and called attention to the remarkable technical advances that have been made since his time. Pointing out that the country's present system of bridges is rapidly being outmoded by ever-increasing traffic demands, Mr. Jansen stated, "It is inevitable that most existing bridges will have to be replaced to tie in with the requirements for a new superhighway system throughout the United States and link it with neighboring countries to the north and south."

Mr. Jansen declared that prior to World War II, Germany in many respects was the leader in bridge design and construction, but that the United States is now in the lead. He added that, "America's technical skill, financial and political responsibility will play a large part in the replacement of European highways, railroads, and bridge structures destroyed during the war.

"The field of bridge engineering," he concluded, "has to place safety above all else, and to forecast how future bridges will differ from existing ones would be difficult because every deviation from present methods must have a background of reasonable certainty before it is used. Lighter metals are being used experimentally in bridge structures and may point the way to one major change. High tensile alloy steels provide certain features of improvement that are receiving consideration and are in use to a considerable degree. Welding techniques in place of riveting are gradually gaining deserved favor."

Allen Wagner Resigns as Public Relations Manager

ALLEN WAGNER, Affiliate ASCE, has resigned as ASCE Public Relations Manager and executive editor of CIVIL ENGINEERING to become publicity director of the American Road Builders' Association, Washington, D.C. A member of the ASCE Headquarters staff since November 1945, Mr. Wagner has had wide experience in newspaper and publicity work. Before coming to the Society he headed the public relations department of the Minnesota Mining and Manufacturing Co., for over four years, and prior to that served as chief executive officer and public relations director of the Minneapolis—St. Paul Sanitary District during construction and operation of the Twin Cities sewage-disposal system. Earlier he was city editor of the St. Paul *Daily News*.

Allen Wagner

H. S. Crocker, Hon. M. and Past-President, Dies

NEWS OF THE sudden death of Past-President Herbert S. Crocker—in Denver, Colo., on March 8—will come as a shock to his friends in the ASCE, which he served in many capacities. Colonel Crocker had the distinction of having filled every Society office except that of Treasurer. He was Director from 1915 to 1917; Vice-President in 1919 and 1920; Secretary in 1920; and President in 1932. A full member since 1901, he was elected to Honorary Membership in 1938.

Herbert S. Crocker

Born in Haverhill, N. H., in 1867, Mr. Crocker received the degree of B.S.C.E. from the University of Michigan in 1889, and the M.E. degree in 1919. Widely known for his work in transportation structures, he had designed notable projects in Chicago, Salt Lake City, and Denver. These included the Colfax-Laramer Viaduct in Denver, one of the longest concrete viaducts in the world. While a member of the Denver Board of Water Commissioners, he served as consulting engineer in charge of the city's $10,000,000 transmountain diversion project.

Colonel Crocker was in consulting practice in Denver from 1907 until his retirement a year ago—most recently as senior member of the firm of Crocker & Ryan, which was engaged during the recent war as architect-engineer on many construction projects for the War Department. In World War I, he served in the Construction Division of the Army, successively as major and lieutenant colonel, and was in charge of building the Brooklyn Army Base.

Colonel Crocker's professional interests, in addition to the Society, included membership on the Advisory Committee on Water Resources of the National Resources Committee, the Administrative Committee of American Engineering Council, and the Mississippi Valley Commission. He was also active in the Western Society of Engineers, and the Colorado Society of Engineers.

Up-to-Date Glossary on Water Terms Available

EXPANDING ON A preliminary announcement in the February issue, this is a specific notice of the availability of a new and valuable engineering tool—the product of 13 years of arduous work by special committees, entitled *Glossary: Water and Sewage Control Engineering*.

FOR CONVENIENCE this comprehensive 276-page Glossary, in a 6 × 9-in. format, is being distributed by the Society on behalf of all the cooperating organizations on a uniform basis. It is furnished in paper covers or in black cloth binding. Since only a limited edition has been provided, it is advisable to place orders promptly. The paper edition is listed at $2.00 per copy, to which a 50 percent discount applies to a member's first copy. The cloth binding costs $1.00 per additional copy. A handy order blank form is given on page 108 of the advertising section.

This volume is a thoroughgoing inventory of words and meanings in a selected engineering specialty, screened and polished by the users themselves, out on the firing line. In this category, it deserves a place in the library of all engineers, and lexicographers will do well to use it as a check list for new editions.

In real measure the completion of this Glossary demonstrates what can be done through constructive collaboration. The initial stage represented the collaboration of the National Resources Planning Board with several professional organizations. The final stage represented the collaboration of ASCE, American Public Health Association, American Water Works Association, and Federation of Sewage Works Associations.

ASCE Delegates Attend UNESCO Conference

INTERNATIONAL COOPERATIVE ASPECTS of scientific and professional organizations and our colleges and universities received major attention at the Second National

Conference of the United States National Commission for UNESCO in Cleveland early this month, which was announced in the March issue. Attending the Conference, at the invitation of the U.S. State Department, as representatives of ASCE were Frank C. Tolles and Prof. George E. Barnes.

Copies of Engineer's Creed May Be Ordered

IN RESPONSE TO numerous requests for copies or reprints of "The Engineer's Creed," reproduced in the November issue of CIVIL ENGINEERING, the Society is making available a supply of de luxe re-

The Engineer's Creed
To Take the Vision
Which Comes from Dreams
And Apply the Magic of Science and Mathematics
Using the Heritage of my Profession
And my Knowledge of Nature's Material
To Create a Design.
To Organize the Efforts and Skills
Of my Fellow Workers
Employing the Capital of the Thrifty
And the Products of many Industries
And Together we Work toward our Goal,
Undaunted by Hazards and Obstacles.
And when we have completed our Task
All can See
That the Dreams and Plans
Have Materialized
For the Comfort and Welfare of All.
I am an Engineer.
I Serve Mankind
By Making Dreams come True.

prints suitable for framing. The reprints will be made on light-weight cream parchment, with an 8½ by 11-in. format. Author of the creed is Adolph J. Ackerman, M. ASCE, and the illumination is the work of Robert W. Hiller, mechanical engineer and artist, of Pittsburgh, Pa.

Copies may be ordered at $1 each, by means of the special blank, provided on page 90 of the advertising section.

Branches Established by Several Local Sections

TO PERMIT ASCE members the fullest possible participation in Local Section affairs, several Sections have recently taken local board action to form Branches or Sub-Sections within their boundaries. Among these are the Mid-South Section, which has established Branches at Little Rock, Ark., and Vicksburg, Miss.; the Montana Section, which now has a Great Falls Branch; and the Philadelphia Section, which recently formed a Delaware Sub-Section, with headquarters at Wilmington, Del.

The formation, on March 16, of a Branch in San Antonio, Tex., will bring to six the number of local groups needed to serve the membership in the geographically vast Texas Section. The other Sub-Sections are the Brazos County, Dallas, Fort Worth, Houston, and Lower Rio Grande Branches.

ASCE Financial Operations for 1948 Shown

SUPPLEMENTING PREVIOUS CIVIL ENGINEERING items on the Society's 1948 financial operations, the following statement from the Annual Report gives exact items of receipt and expenditure. Previous items include Executive Secretary William N. Carey's summary of the Annual Report, together with a graphic presentation of ASCE fiscal operations for the year, in the February issue, and an item on CIVIL ENGINEERING fiscal operations, in the March issue.

REPORT OF THE SECRETARY FOR FISCAL YEAR ENDING SEPTEMBER 30, 1948

To the Board of Direction of the American Society of Civil Engineers

RECEIPTS

Current Operations:		
Entrance Fees		$ 51,459.57
Dues: 1947	$ 16,878.29	
1948	338,225.14	
Advance—Past	2,548.90	357,652.33
Compounded		2,275.00
Sale of Publications		67,745.47
Binding of *Transactions*		12,386.50
Binding of Index (Vol. 84–112)		10,865.50
Badges and Certificates		14,325.93
Annual Meeting		13,103.85
Advertising		129,666.71
Miscellaneous		6,757.32
Society Investments:		
Interest and Dividends on Current Investments		2,259.45
Income from Real Estate:		
220 West 57th St., New York City	$ 52,500.00	
33 West 39th St., New York City (Interest Allowance)	500.00	53,000.00
Voluntary Fund		10,715.42
Total Budget Receipts		732,213.05
Capital:		
Bank Loan (Less Discount)		24,956.50
Other Sources		2,405.24
Cash on hand—October 1, 1947		16,907.20
		$776,481.99

EXPENDITURES

General Supervision:		
Board of Direction		$ 28,434.96
General Administration		39,900.01
Accounting		20,718.35
General Service to Members:		
Membership Applications		26,213.96
Subscriptions		2,808.22
Membership Records		11,727.40
Balloting		4,058.75
Badges and Certificates		9,699.35
Prizes		1,984.50
Miscellaneous		12,065.96
Reading Room		1,968.77
Library		10,819.70
Annual Meeting		16,999.35
Regional Meetings		9,100.86
Professional Activities		14,817.30
Special Activities:		
Engineers Joint Council		3,835.96
Research Committee		202.96
Office, Eastern Representative		10,644.25
Office, Mid-West Representative		10,348.10
Office, Western Representative		12,843.62
Public Relations		9,039.50
Publications:		
Transactions (Vol. 112)	$ 33,537.53	
Transactions Index (Vol. 84–112)	4,683.15	
Proceedings	72,648.63	
Civil Engineering Editorial	$92,248.25	
Civil Engineering—Advertising	71,917.52	164,165.77
Memoirs		3,582.89
Manuals		2,285.35
Reprints		3,441.69
E. J. C. Economic Status Report		4,437.83
Official Register		5,668.94
		294,451.76
Group Activities:		
Technical Divisions:		
Administration	$ 12,739.36	
Technical Committees	5,735.72	18,475.08
Local Sections		24,467.46
Student Chapters		6,545.52
Assistance to Other Organizations:		
Engineers Council for Professional Development		1,855.75
National Council of State Boards of Engineering Examiners		500.00
Overhead:		
Retirement Payments		10,261.80
Retirement and Disability Fund		9,532.45
Office Overhead		15,864.11
Rent, before Interest Allowance		36,438.00
Structural Repairs and Improvements		76.25
Capital:		
Furniture and Equipment		2,944.63
Total Budget Expenditures		679,951.26
Investments		1,500.00
Bank Loans		90,000.00
Cash on hand—September 30, 1948		5,030.73
		$776,481.99

EJC Legislation Panel Testifies Before House Committee

CONTINUATION OF THE professional provisions of the Taft-Hartley Act in any new labor relations law was recommended by the EJC Labor Legislation Panel in testimony before the House Committee on Education and Labor on March 10. The panel, representing more than 100,000 engineers, testified before the Senate Committee on Labor and Public Welfare in February (see March issue, page 51).

Both committees appeared to be in sympathy with the objectives expressed by the panel. However, the Senate Committee reported out its Thomas Bill, S. 249, which contains nothing that will permit professional employees to maintain the independence of action that has been possible under the Taft-Hartley Act.

Hearings on the House version of the bill, HR 2032, which is identical with Senate Bill, S. 249, have been completed, and the Committee has followed the pattern set in the Senate by reporting it out exactly as written. Members of both the Senate and House have declared their intentions to present amendments to the respective bills when they come up for floor debate.

Former Director Colpitts of Eng. Foundation Dies

EDWIN H. COLPITTS, director of Engineering Foundation from 1941 until his resignation in January 1949 because of illness, died on March 6, at the age of 77. Mr. Colpitts had a long career with the Bell Telephone Laboratories, retiring as vice-president in 1937. He is credited with pioneer achievements in the development of long-distance wire and radio communication and the trans-Atlantic telephone. During the recent war, he served with the Anti-Submarine Warfare Division of the National Defense Research Committee, receiving the Medal of Merit for his "adroit and expert advice and effective guidance."

Reinstatements and Resignations Listed

WITH DISCONTINUANCE OF the publication of membership applications, additions, and transfers in CIVIL ENGINEERING, by recent action of the ASCE Board of Direction, reinstatements and resignations are being published in "Society News." The current list follows:

Reinstatements

BARBER, EARL HUNTINGTON, Assoc. M., Cons. Engr., 110 Haven St., Reading, Mass., reinstated Feb. 17, 1949.

BOLIVAR, CARLETON EARL, Jun., Civ. Engr., U.S. Bureau of Reclamation, Denver Federal Center (Res., 2845 West Bayaud Ave.), Denver, Colo., reinstated Feb. 23, 1949.

DAVIDOFF, JAMES EUGENE, Jun., G-4 Construction, USARPAC, A.P.O. 958, Care, Postmaster, San Francisco, Calif., reinstated Feb. 14, 1949.

MALONE, GEORGE WILSON, Assoc. M., Hon., Senator, U.S. Senate, Committee on Interior & Insular Affairs, Washington 25, D.C., reinstated Feb. 21, 1949.

MAURY, RICHARD FONTAINE, M., Avenida Maipu 1430, Buenos Aires, Argentina, S.A., reinstated Feb. 17, 1949.

ROTH, ARTHUR T., Jun., Box 56, AWS SC, Quantico, Va., reinstated Jan. 1, 1949.

Resignations

BALLOCK, JAMES ARTHUR, Jun., Asst. Div. Engr., R F & P R R. Co., Room 207, Broad St. Station, Richmond, Va., resigned Feb. 25, 1949.

BERGE, PAUL SUNDBY, Jun., 1st Lt., Corps of Engineers, U.S.A., Rawson, N.Dak., resigned Jan. 24, 1949.

GREEN, JOSEPH, Assoc. M., Struct. Designer, George W. Saathoff, 60 Wall St. (Res., 620 Fort Washington Ave.), New York, N.Y., resigned Feb. 1, 1949.

GREENE, KENNETH EDWARD, Jun., Struct. Engr., Affiliated Engineers & Contractors, 917 Seventh St., Sacramento (Res., 110 Stanford Village, Stanford), Calif., resigned Feb. 4, 1949.

HAHN, CLIFFORD AYLWARD, M., Vice-Pres., The Holtzer-Cabot Electric Co., 400 Stuart St., Boston (Res., 153 No. Ave., Weston), Mass., resigned Feb. 24, 1949.

JACKSON, CLIVE TANNER, Jun., Eng. Aide, Naval Civil Service, San Diego Aqueduct Project, Vista (Res., 4312 Keever, Long Beach), Calif., resigned Feb. 7, 1949.

LAVERTY, FRANCIS JOHN, M., Supt. of Public Works, City of Ithaca, City Hall, Ithaca, N.Y., resigned Feb. 1, 1949.

LOOPER, JOSEPH HENRY, Jun., Ensign, U.S.N.R., Lovell, Wyo., resigned Feb. 24, 1949.

PATRICK, JOE PEELER, Jun., Struct. Designer, Roberts & Schaefer Co., Contr. Engrs., 307 No. Michigan (Res., 1551 West Olive Ave.), Chicago, Ill., resigned Jan. 31, 1949.

REEVES, ROBERT EUGENE, Jun., Student, Illinois Institute of Technology (Res., 5215 Blackstone Ave.), Chicago 15, Ill., resigned Feb. 23, 1949.

STANSFIELD, DONALD HITCHEN, Jun., Associate City Planner, City of Dayton, 530 Municipal Bldg. (Res., 3630 Stanford Pl.), Dayton, Ohio, resigned Feb. 8, 1949.

STIVERS, EARL RAIMON, Assoc. M., Director of Research, Package Research Laboratory (Res., 26 Rockaway Ave.), Rockaway, N.J., resigned Feb. 1, 1949.

VOWINKEL, EDWARD AUGUST, Jun., Design-Draftsman, N. W. Kellogg Co., 225 Broadway (Res., 17 Hillcrest St., Great Kills St.), N.Y., resigned Feb. 10, 1949.

TOTAL MEMBERSHIP AS OF MARCH 9, 1949

Members	7,272
Associate Members	9,427
Corporate Members	16,699
Honorary Members	43
Juniors	8,415
Affiliates	72
Fellows	1
Total	25,230
(March 9, 1948	22,947)

NEWS OF LOCAL SECTIONS

Coming Events

Central Ohio—Joint dinner meeting with the Columbus Chapter of American Institute of Architects, at the Chittenden Hotel, April 20, at 6:15 p.m.

Cleveland—Meeting at the Cleveland Engineering Society, Cleveland, on April 15, at 8 p.m.; dinner at 6:30 p.m.

Colorado—Meetings at the Oxford Hotel, Denver, April 11 and May 9.

Kansas—Meeting at Topeka on April 15.

Maryland—Joint meeting with the Johns Hopkins University and the University of Maryland Student Chapter at the Engineers' Club in Baltimore, April 13, at 8 p.m.

Metropolitan—Meeting in the Engineering Societies Building, April 20, at 8 p.m. Junior Branch to meet at ASCE Headquarters, April 13 and 27, at 7:30 p.m. Junior meetings preceded by dinner in the New York Times dining room at 6 p.m.

North Carolina—Spring meeting at Duke University in Durham, on May 7.

Northwestern—Dinner meeting in the Coffman Memorial Union of the University of Minnesota, Minneapolis, April 4, at 6:30 p.m.

Philadelphia—Joint meeting with the Engineers' Club of Trenton, at the Philadelphia Engineers Club on April 12, at 7:30 p.m.

Pittsburgh—Meeting in the Fort Pitt Room of the William Penn Hotel, Pittsburgh, April 19, 8 p.m. The Junior Activities Committee will sponsor a dinner meeting for Juniors at the Downtown Y.M.C.A. in Pittsburgh, April 12.

Rochester—Meeting at the Rochester Hotel, May 4, at 8:15 p.m.

Spokane—Joint meeting with local student chapters and the Columbia Branch, at Coulee Dam, April 23.

Texas—Spring meeting at San Angelo, April 28 through 30. Dallas Branch luncheon meeting at the Adolphus Hotel, Dallas, May 2.

Virginia—Joint meeting with the Central Virginia Engineers' Club at Ewarts Cafeteria, Richmond, April 15, at 5:45 p.m.

West Virginia—Spring meeting at Parkersburg, April 22, will feature a field trip in the afternoon and banquet in the evening.

Wisconsin—Meeting in the Engineering Society of Milwaukee Building on April 11; dinner at 6:30 p.m. and meeting at 8 p.m.

Recent Activities

CENTRAL ILLINOIS

SANITARY ENGINEERING PROBLEMS that must be solved in the disposal of atomic wastes and the handling of radioactive materials were discussed at the March 7 meeting by C. W. Klassen, chief sanitary engineer of the Illinois State Department of Public Health. A resolution protesting a bill pending in the state legislature that would permit certain groups to practice professional engineering without licensing was adopted during the business session. At another recent meeting, Kenneth S. Carlston, professor of law at the University of Illinois, spoke on "The Engineer and the Law." The Section voted to support the Illinois Section in its candidacy of Louis R. Howson for ASCE Director, with the understanding that the Section support the Central Illinois Section candidate at the end of Mr. Howson's term.

CINCINNATI

EVENTS LEADING UP to the execution of the Ohio River Valley Water Sanitation Compact were outlined at a recent meeting by Hudson Biery, chairman of the Ohio River Valley Water Sanitation Commission. An enthusiastic discussion followed his talk. Results of the election of new Section officers are Truman P. Young, president; Robert R. Philippe, vice-president; and John A. Diehl, secretary-treasurer.

COLORADO

THE HARRINGTON PLAN for reorganization of the ASCE was among Society and Section affairs discussed at a recent meeting of the Colorado Section. The technical program consisted of a talk on the various engineering and construction problems encountered in the planning and building of Cherry Creek Dam, southeast of Denver, by Colonel Neff, of the Army Corps of Engineers.

DISTRICT OF COLUMBIA

THE ENGINEERING PROFESSION will have to assume even greater responsibility for social and economic problems, as one of the penalties of its preeminent position in technology, the Hon. Oscar L. Chapman, Under Secretary of the Department of the Interior, told members of the Section at their March meeting. Speaking on "The Social Responsibilities of the Engineer," Mr. Chapman cited the participation of the profession in such cooperative endeavors as Engineers Joint Council and the International Technical Congress in Paris in 1947 as a step in the right direction. Among the technological problems, with social implications, that will challenge the profession in the next 20 years, Mr. Chapman listed the conservation of our natural resources; the development of hydroelectric power; the production of atomic energy; the development of synthetic liquid fuels from coal and shale to supplement our petroleum supplies; and improvements in the field of water supply. ASCE Assistant Secretary E. L. Chandler reported on EJC activities and the status of the labor bill. At another recent meeting, Marshall O. Leighton, Washington consultant, described the development of the principle of upstream reservoirs for flood-control purposes.

DULUTH

W. VAN STEINBERG, DIRECTOR OF safety for the American Red Cross, outlined the organization's safety training and first aid program at a recent meeting of the Duluth Section. Mr. Van Steinberg stressed the value to the community of having a number of persons with such training.

ILLINOIS

INTRODUCING A BIMONTHLY mimeographed news letter to the membership of the Illinois Section, President C. H. Mottier writes that, "It represents a modest beginning on the part of your officers to create interest in and improve the status of the Illinois Section." The new publication, which is edited by A. L. R. Sanders, will include meeting announcements, programs of Section activities, personals, and general Section news. Recent speakers at the Friday luncheons, sponsored by the Section, include E. J. Fucik and I. F. Stern. Both reminisced about their early experience in the profession.

GEORGIA

SLUM CLEARANCE WAS presented as one of the major problems of the City of Atlanta at the March meeting of the Georgia Section by John A. White, city councilman and chairman of the local Slum Clearance Committee. Mr. White pointed out that about 20 percent of the city's population lives in substandard dwellings, and that there are approximately 33,000 unimproved units in the slum areas. Although only 6 percent of the tax income of the municipality is derived from these areas, 45 percent of the tax income is spent for services there, he stated. A recent bond issue of local, federal, and state allotments will provide funds for the partial alleviation of this condition, Mr. White said, though the urgent need, which should be met by local builders, is the construction of rental housing units."

INTERMOUNTAIN

ENGINEERING REGISTRATION WAS discussed by a panel of local speakers at a recent dinner meeting. These were Wm. Templeton, Salt Lake City consultant, who launched the program with a discussion of existing laws on the distinction between architectural and engineering fields of practice; Adelbert Diefendorf, head of the civil engineering department at the University of Utah, who dealt with professional definitions of engineer and engineer in training; Prof. R. L. Sloane, of the University of Utah, who discussed oral and written examinations for registration; and Glen Enke, engineer with the Utah Construction Co., who commented on the desirability of the registration requirement in the structural field. A general discussion from the floor concluded the program.

IOWA

SUBSURFACE WATER CONDITIONS at the site of a proposed underpass for the Illinois Central Railroad at Waterloo, Iowa, were described at a recent meeting by Bert Meyers, of the Iowa Highway Commission. Announcement of the award of the Section's annual prizes of Junior membership in the Society, to Keith Carlton, of Iowa State College, and Gene Guetzko, of the University of Iowa, was made during the business session.

KANSAS

SPEAKING ON "SPECIAL Concrete for Specific Jobs" at a recent meeting, B. D. Keatts, regional vice-president of Intrusion-Prepakt, Inc., Cleveland, showed by means of slides how such materials may be used in the repair of tunnels and other masonry structures. During the business session, Section President Reed Morse discussed the reorganization of the Kansas Engineering Council and the proposed Architects Registration Law recently introduced in the state legislature.

KANSAS CITY

COMPARISONS BETWEEN THE Scandinavian economy and ours were made in the featured talk at a recent meeting by M. C. Ensinger, president and general manager of the Union Wire Rope Corp. During the business session, a resolution favoring former ASCE Vice-President Ernest E. Howard as a candidate for the office of

sident of the Society next year was animously passed by the Section. Mr. ward explained the background of the posed plan for the reorganization of ASCE, and a motion was made to e Section officers study the matter ther.

LEHIGH VALLEY

PHOTOGRAMMETRY AND ITS application the engineering problems of the country re discussed by Robert H. Smith, pro- tion manager of Aero Service Corp., iladelphia, at a recent joint meeting of Lehigh Valley Section and the La- ette College and Lehigh University dent Chapters. Mr. Smith explained thods used by his company in aerial ographic mapping, and outlined the n's extensive work on the design and ation of the proposed Pennsylvania rnpike Extension and for the Cleveland y Planning Commission.

LOS ANGELES

A TALK ON "Construction Factors of Garrison Dam Project," by Prof. W. Bobisch, of the California Institute of chnology, launched the technical pro- m at a recent dinner meeting of the s Angeles Section. In a former associa- n with the Army Corps of Engineers, ofessor Bobisch was engaged on this e rolled-fill earth dam. The second tured speaker was Samuel Hobbs, d engineer for the Portland Cement sociation, who discussed "Building h Tilt-Up." This method of construc- n now receiving considerable attention s illustrated by a colored motion pic- e. ASCE Honorary Member Horace King, of Ann Arbor, Mich., was intro- ed to the group by Franklin Thomas, sident of the Society, and spoke briefly. At the regular monthly meeting of the nior Forum preceding the Section eting, A. L. Williams, of the Los geles Department of Water and Power, sented a moving picture, entitled outhern California and the Colorado er."

METROPOLITAN

RECENT DEVELOPMENTS IN the prac- l application of structural welding e covered by LaMotte Grover, weld- engineer for the Air Reduction Sales , at a joint meeting with the New k section of the American Welding iety on March 16. Mr. Grover also ussed the role that research has yed in orienting design and construc- practices. His talk was illustrated h slides showing the welding of bridges other structures. There was a ca- ity attendance of over 400.

Problems entailed in the vast work of sing of New York City's 23,000,000 d of garbage each year were discussed at the March 9 meeting of the Junior Branch by C. A. Rogus, chief of the New York City Department of Sanitation. For the first time, Mr. Rogus told the group, engineers are being assigned to the problem, and time and motion studies are being made. In the present method of disposal, much garbage is being used for landfills.

MARYLAND

BOTH THE CIVIL engineering profession and the construction industry will be called upon to play leading roles in carrying out the country's huge construction program, A. N. Carter, manager of the Highway Division of the Associated General Contractors of America, told members of the Maryland Section at a recent dinner meeting. According to Mr. Carter, results of a survey conducted by the American Association of State Highway Officials show the need for 22 billion dollars of highway construction and an estimated 12,000 engineers to do the work. Mr. Carter, who has just completed a 25,000-mile tour of the United States, showed colored slides of highway and airport construction practices throughout the nation. The background of the proposed plan for ASCE reorganization was explained during the business session by Society Director Paul Holland.

MIAMI

BUILDINGS, ROADS, AND water supply projects of the Stone Age were discussed at the March meeting by the Rev. Charles W. Harris, author and retired chaplain of Lafayette College. Speaking on "The Mayan Achievements," Mr. Harris gave a graphic picture of the engineering and architectural developments of the Indians in Yucatan thousands of years ago. In presenting a report of the Section's recently appointed Committee on Floods, F. H. Weed stated that the work of the committee has already resulted in legislative action, at both state and county level, to protect purchasers of land subject to floods.

MID-MISSOURI

ASCE VICE-PRESIDENT Robert B. Brooks attended the March meeting of the Mid-Missouri Section at Rolla, and discussed current activities of the Board of Direction. He also commented on engineering and other conditions in Europe, basing his observations on a recent visit abroad. During the business session, Junior Director Jasper K. Roberts outlined plans for canvassing Juniors on their ideas for obtaining closer contacts with the older members of the profession. Certificates of life membership were presented to William H. Smith and Cecil S. Bumann.

MONTANA

AMENDMENT OF THE state law covering registration of civil engineers to include other branches of the profession was opposed by the Section at a special meeting called to discuss a bill now before the legislature that would provide for such amendment. Though favoring ultimate inclusion of all engineering groups in the registration law, the Section opposed present attempts at amendment on the ground that they might jeopardize recent registration gains by throwing out the present law. A move under way to organize a new professional engineers group in the state was also discussed at length. The organization and operation of the Montana Power Co. were described at another meeting by George Renault, electrical superintendent for the company.

NEW MEXICO

UNLIKE MOST COUNTRIES, Venezuela is short of suitable irrigable land rather than of water with which to irrigate, John L. Mutz, New Mexico area planning engineer for the Bureau of Reclamation, said in a talk on "Irrigation in Venezuela," given at a recent meeting. Mr. Mutz stated that Venezuela is comparatively rich in natural resources, and that great strides have been made in recent years in developing an irrigation system. None the less, he said, a large percentage of foodstuffs is imported because of the lack of cultivable soil. Mr. Mutz supplemented his talk with slides made during an assignment in Venezuela.

NORTHWESTERN

AIRPORT FACILITIES WERE discussed by a panel of local speakers at a recent Section dinner meeting. These included Robert Aldrich, director of the Minneapolis-St. Paul Metropolitan Airport Commission, who described legislative and other progress made to date in developing airport facilities for the Twin-Cities area; A. J. Duvall, of the local consulting firm of Toltz, King & Day, who commented on the design of facilities at the Wold-Chamberlin Airport in Minneapolis; and Paul L. Thomas, of Northwest Airlines, who discussed the development of his organization's facilities in the United States and the Orient. During the business session, Russell A. Holcomb, of the University of Minnesota, was honored with the award of the Section's annual undergraduate scholarship of $200 for scholastic attainment.

Members of the Junior Forum were recent dinner guests of the Armco Drainage and Metal Products Co. The various processes of constructing culverts were demonstrated and explained in an inspection tour of the plant, followed by talks by H. W. Claybaugh and H. S. Loeffler.

NORTHEASTERN

ACTUAL AVERAGE EARNINGS for engineering employees in private practice in Boston are now about $400 per month, based on the adjusted results of a survey made by the Section's Committee on Salaries and Employment Conditions three years ago, according to a statement in the Committees's 1948 annual report, which was presented at a recent meeting. Stating that an increase of about 20 percent over this figure is indicated, especially in the group with from 2 to 10 years of experience, the report stresses the responsibility of the professional employee to "earn and deserve the increase." Noting that "the years since the war have been marked by a decrease in productivity and a decline in quality of output," the report concludes that, "this trend must be reversed. In engineering as in industry, production must rise faster than wages to achieve sound and lasting prosperity."

OKLAHOMA

PROGRESS MADE IN planning the Spring Meeting of the Society, to which the Section will be host in April, was reviewed by David Benham, chairman of the committee in charge of arrangements, and various subcommittee chairmen at a recent meeting of the Section. A short talk on the affairs of the Society, by ASCE Director Webster L. Benham, concluded the program.

The standard practice code of the American Institute of Steel Construction has been adopted by 365 cities in the United States, N. R. Patterson, president of the Institute, stated at a recent meeting of the Tulsa Branch of the Oklahoma Section. Mr. Patterson was assisted in his discussion of modern developments in steel construction by George Lamb, district engineer for the Institute. Henry K. Shane, newly elected chairman of the Tulsa Branch, gave a brief résumé of the Branch's plans for participation in the Society's Spring Meeting.

PITTSBURGH

"THE UNWRITTEN LAWS of Engineering" were discussed at a recent joint meeting with the ASME and other local engineering groups by W. Julian King, director of the Sibley School of Mechanical Engineering at Cornell University, in a talk that provoked a two-hour discussion from the floor. At a meeting of Juniors, sponsored by the Junior Activities Committee on March 10, it was decided to form a Junior Division of the Section, with offices of chairman and secretary to be filled by the group at its next meeting. The speakers on the technical program were George Crowley, of the Cement Stone Corp., who discussed "Precast Concrete Buildings," and Robert Dawson, of Carnegie Institute of Technology, whose subject was "Alterations to Existing Buildings."

PHILADELPHIA

BARRING WAR OR depression, construction costs during the next five years will be stabilized at approximately 5 percent, plus or minus, of current costs, in the opinion of J. P. H. Perry, vice-president of the Turner Construction Co., of New York City, who addressed the March 8 meeting of the Philadelphia Section. Speaking on "Construction Trends," Mr. Perry supported his views with statistics compiled by analysts of his own company. More than 200 attended the dinner meeting, to which the newly formed Delaware Sub-Section was host, in Wilmington.

SACRAMENTO

ASCE PRESIDENT FRANKLIN Thomas attended a recent luncheon meeting of the Section and spoke briefly on the proposed plan for reorganization of the Society. In a talk on "Frontier of Development," constituting the technical program, J. B. Condliffe, chairman of the Bureau of Economics at the University of California, discussed current economic problems. According to Dr. Condliffe, 1949 may be a trying year of economic adjustments. At another recent luncheon meeting, Sherwood Morrill, document examiner for the State Division of Criminal Identification and Investigation, described with the aid of slides how counterfeit money is detected.

ST. LOUIS

SOCIETY AFFAIRS were discussed at both the national and Local Section level by a panel of ASCE and Section speakers at a recent luncheon meeting. Past-President W. W. Horner reviewed recent Board of Direction activities, substituting on the program for ASCE Vice-President Robert B. Brooks who was ill and unable to attend the meeting. An over-all report of the Annual Meeting in New York was given by J. W. Hubler, vice-president of the Section and professor of civil engineering at Washington University. A report of the Section's Membership Committee brought out the fact that, in the two months since the Section's annual meeting the Section has gained 31 new members, bringing its total membership to 404. A discussion of the proposed plan for reorganization of the Society, headed by President Crecelius, concluded the program.

SAN DIEGO

SAN DIEGO WILL soon be getting natural gas from Texas, through connections with the 1,200-mile, 30-in. pipeline link-ing California and the Lone Star State. Ralph Phillips, engineer in charge of sales for the San Diego Gas and Electric Co. told members of the San Diego Section at a recent dinner meeting. Mr. Phillips showed colored motion pictures of construction work on the huge pipeline project. A certificate of life membership in the Society was presented to C. R. Rankin during the business session.

SAN FRANCISCO

PROBLEMS CONNECTED with construction of the proposed additional toll bridge crossings of San Francisco Bay were debated at the first Section meeting of the year, following the presentation of a report on the subject by Ralph A. Tudor, chief engineer of San Francisco Bay Toll Crossings. Conceding that general benefits to the Bay area are secondary in consideration to the traffic problem, Mr. Tudor stated his recommendations for two structures, financed and built one at a time and beginning with a span paralleling the present Bay crossing, before a capacity attendance. ASCE President Thomas attended the meeting and presented Society prizes for papers to three members of the Section, who were unable to attend the ASCE Annual Meeting in New York in January—Prof. John K. Vennard, recipient of the Collingwood Prize; Hyatt Forbes, winner of the James Laurie Prize; and Frank Kersnar, recipient of the Daniel Mead Student Chapter award.

SEATTLE

IMPRESSIONS OF POSTWAR construction methods in Europe were given at a recent meeting by George Vincent, principal highway engineer for the Public Roads Administration. One of two PRA delegates to the International Association for Bridge and Structural Engineering, held in Brussels in September 1948, Mr. Vincent gave an outline of the convention program, and compared present European construction practices with past methods. Subjects discussed during the business session included the proposed plan for ASCE reorganization.

SOUTH CAROLINA

New Section officers, elected at the recent annual meeting in Columbia, are Prof. H. E. Glenn, president; Alec Brown, vice-president; and Albert Johnson, secretary-treasurer. Technical speakers at the all-day meeting, held jointly with the South Carolina Society of Engineers, included L. B. Dworsky, sanitary engineer for the U.S. Public Health Service, Washington, D.C., who discussed stream pollution; Hamilton Lott, chief engineer for Palmetto Quarries, Co., who described the process

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manufacturing concrete brick; and R. G. Coker, secretary and chief engineer of the Sonoco Products Co., Hartsville, S.C., whose topic was "Engineering in a South Carolina Industry." Representatives of the three Student Chapters in the state were guests of the Section at the meeting, and spoke briefly on Chapter affairs.

SPOKANE

SOCIETY DIRECTOR W. L. Malony outlined Board of Direction and other activities of the ASCE Annual Meeting in New York at a regular business meeting of the Section. Mr. Malony also headed a general discussion of the proposed plan for reorganization of the Society.

TEXAS

COMMON MISCONCEPTIONS IN standard engineering practice were discussed at a luncheon meeting of the Fort Worth Branch by Charles M. Davis, Fort Worth consultant. Stating that engineers often base their decisions on inaccurate assumptions, Mr. Davis said in illustration of his point that high water-cement ratios do not necessarily lower the ultimate strength of concrete as much as is often supposed, and that the subject of failure in reinforced concrete construction due to bond failure has been overemphasized.

WISCONSIN

FABRICATION OF STRUCTURAL shapes by arc welding was described at a recent dinner meeting by E. C. Brekelbaum, chief engineer of the Harnischfeger Corp., Milwaukee. Mr. Brekelbaum commented especially on current welding practices in his company's manufacture of light and heavy powered earth-moving equipment. Former Society Director R. W. Gamble led a discussion of the proposed ASCE reorganization.

MARQUETTE UNIVERSITY

TWO ALLIS-CHALMERS Co. motion pictures on torque convertors and graders were shown at a recent meeting of the Marquette University Student Chapter. During the business session, various committee reports were read, and plans were made for participation in the Midwest Student Chapter Conference, to take place at Northwestern University on April 22 and 23.

UNIVERSITY OF CALIFORNIA

ENGINEERING GRADUATES have many opportunities for furthering their education, Prof. J. Kelly, head of the Engineering Extension Division at the University of California, said in a talk before the Student Chapter at the semiannual University banquet in honor of graduating seniors. Professor Kelly's theme was "Learning for Fun." Officers elected for the spring semester are: President Bob Crommelin; Vice-President Kurt Gerstle; Secretary (recording) Charles Zell; Secretary (corresponding) William Records; Treasurer John Turner; Senior Representative Jim Naftzger; and Junior Representative Roger Troxell.

NORWICH UNIVERSITY

THE SECRETARY OF the Norwich University Student Chapter reports that 100 percent membership of students eligible under the ASCE rules for membership has been attained.

STUDENT CHAPTER Notes

BROOKLYN POLYTECHNIC INSTITUTE

TO BRING STUDENTS, faculty, and alumni together and provide students with up-to-date information in the technical field, the Brooklyn Polytechnic Institute Student Chapter has launched a new publication to be known as *Strictly Civil*. At the evening session of the BPI Chapter meeting, Sherman Glass, formerly on the faculty of BPI, delivered an instructive talk on the Civil Engineer Corps of the U.S. Navy. Mr. Glass, at present a structural designer with Parsons, Brinkerhoff, Hall & Macdonald and a lieutenant in the CE Corps Reserve, outlined the organization and growth, and responsibilities of the Corps. He conducted an open discussion period at the conclusion of the meeting.

CITY COLLEGE OF NEW YORK

HOW THE ENGINEER LIVES in South America—a talk supplemented with colored slides of interesting architectural features of buildings south of the Border—was given by Steve Locantore at a joint meeting of the Dam Club and City College Student Chapter. Mr. Locantore has handled construction work for the Raymond Concrete Pile Co. in South America and supervised a housing project in Venezuela.

GEORGE WASHINGTON UNIVERSITY

MEMBERS OF THE George Washington University Student Chapter recently were conducted on an inspection tour of the Whitehurst Memorial Freeway, now being constructed over K Street in Washington, D.C., by Alexander and Repass, local contractors. To give an over-all picture of the project, blueprints of the job were studied prior to inspection of the site. The group viewed the almost completed west approach of the overpass, which constitutes one-third of the entire project, and watched operation of the Pumpcrete machine used to pump the concrete for the floor slab up from the street level, a distance of 30 ft.

ASCE PAST-PRESIDENT E. M. HASTINGS (third from left) is honored by Virginia Military Institute Student Chapter with first Chapter award of honorary membership, in recognition of his long service as Contact Member for VMI Chapter. Photo shows, left to right, P. A. Rice, president of Virginia Section; Cadet Paul S. Fleming, chairman of executive committee of Student Chapter, who made address of presentation; Mr. Hastings; and R. A. Marr, Jr., Faculty Adviser for VMI Chapter.

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NEWS BRIEFS

Full Cooperation Between Engineers and Contractors Urged at AGC Convention

BETTER CONSTRUCTION at lower costs should be a dominant aim of such cooperative enterprises of the engineers and contractors as the recently formed Joint Cooperative Committee of the ASCE and AGC, Richard E. Dougherty, Past-President of the Society, told the 1,200 members of the Associated General Contractors of America in attendance at the recent 30th annual convention of the AGC in New York City. Mr. Dougherty stated that "throughout the country there is a vast amount of work being held in abeyance pending greater stabilization in the construction industry and greater certainty as to costs, particularly if the job is of magnitude."

Collaboration between the two professional groups in endeavoring to interest college students in construction careers was urged by Mr. Dougherty as another important concern of both groups. Suggesting that the Joint Committee foster summer employment programs in construction work in the ASCE Student Chapters, he declared, "I do not believe there is anything more important in the affairs of such societies as yours and ours than active interest in the younger men who will eventually take over."

Cooperation in Student Chapter Program

Mr. Dougherty's suggestion for cooperation at Student Chapter level was implemented later by the AGC, which passed a resolution recommending to its members and chapters "that they cooperate with the American Society of Civil Engineers in means of improving the education and training of engineers, and in encouraging them to enter the construction industry." A further resolution recommended discontinuing the establishment of new AGC student chapters and arranging for absorbing existing chapters with chapters of the ASCE or American Institute of Architects, upon the action of those organizations to feature AGC principles of construction operations in their student chapter programs.

Members Address Contractors' Luncheon

Addressing a special contractors' luncheon, held during the four-day convention, Rear Admiral J. J. Manning, M. ASCE, chief of the Navy Bureau of Yards and Docks, stated that money cannot buy the kind of service the construction industry contributed to the winning of World War II. However, he warned that the construction methods that achieved such notable results in World War II would be inadequate for a future emergency, and advocated a program of increased cooperation between the contractors and the Navy Civil Engineer Corps in the interests of national defense. He suggested the program take the form of intensive research for new materials, new equipment, and improved construction methods.

In a talk on "The Time Element of the Road-Building Program," presented at the same luncheon, ASCE Honorary Member Thomas H. MacDonald, Commissioner of Public Roads, called attention to the fact that, "The expansion of state highway engineering staffs to meet the requirements of the increased construction program has lagged in a number of states, principally for lack of reasonable salary inducements," and advocated "aggressive engineer training and recruitment programs, as an inducement to engineer graduates to enter the highway engineering profession."

PROMINENT AMONG SPEAKERS AT RECENT AGC CONVENTION in New York City were ASCE Past-President R. E. Dougherty and Honorary Member Thomas H. MacDonald (left and center in lower photo) shown with Walter L. Couse, of Detroit, Mich., newly elected vice-president of AGC. Upper view shows, left to right, Rear Admiral Kirby Smith, M. ASCE, vice-president of Raymond Concrete Pile Co., and chairman of Executive Committee of ASCE Construction Division; Rear Admiral J. J. Manning, M. ASCE, chief of Navy Bureau of Yards and Docks and featured speaker at luncheon session; and A. S. Horner, Assoc. M. ASCE, of Denver, Colo., 1949 chairman of AGC Heavy Construction and Railroad Contractors Division.

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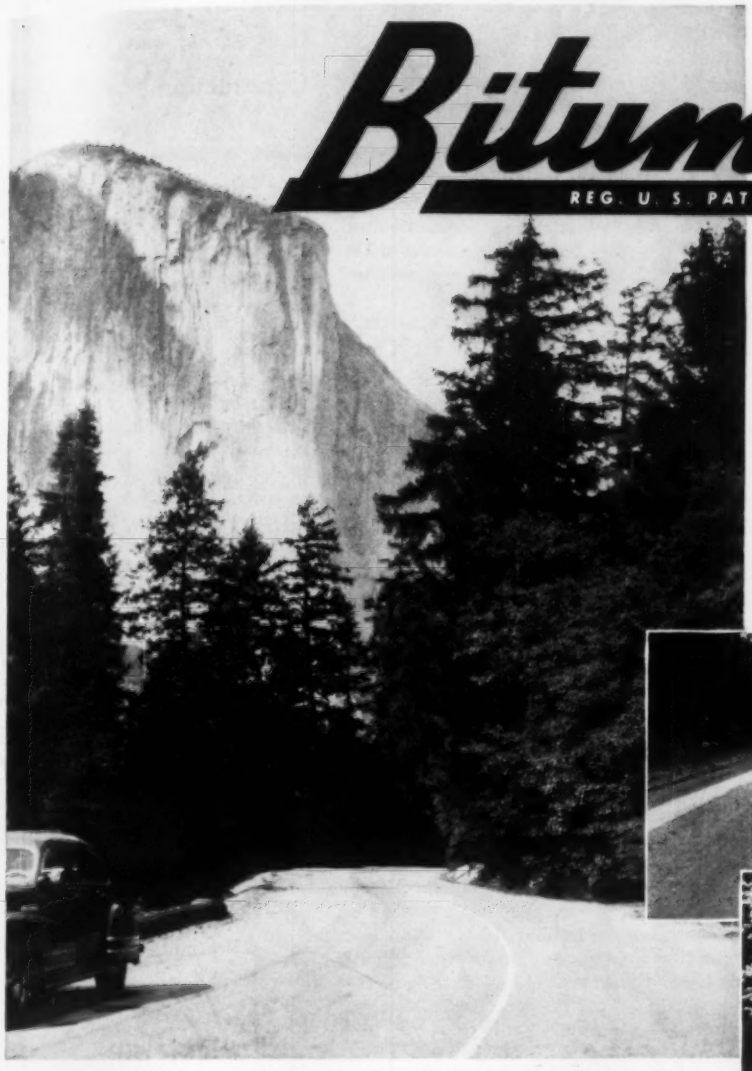

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Construction Forecast

In his annual report to the convention, Managing Director H. E. Foreman stated that, "The construction industry should be able to execute a larger volume of work faster and more efficiently during 1949 than in any year since the end of the war," and reported "the potentials for a record-breaking volume of $18,750,000,000 in new construction and an additional $6,000,000,000 in maintenance and repair operations during the year." Mr. Foreman also cited AGC cooperation with such professional organizations as the ASCE as a vital step in "improving the services of the construction industry."

The annual AGC forecast of the construction situation, based on a survey of opinion from affiliated contractor organizations all over the country, indicates that construction costs are stabilizing or showing a tendency to decline slightly. Predicting that the volume of new construction will exceed the $17,700,000,000 record established in 1948, the contractors report that increases in public works will tend to offset indicated reductions in industrial and commercial construction. Materials—except for steel and, in some areas, cement—and construction machinery, except some of the heavier and specialized items, are reported in relatively plentiful supply after years of shortages. Recent critical labor shortages are also being alleviated, according to the survey.

Officers Elected

In the closing session of the convention, Adolph Teichert, Jr., president of the Sacramento, Calif., contracting firm of A. Teichert & Son, Inc., was inducted into office as president, succeeding Dwight W. Winkelman, and Walter L. Couse, of Detroit, was installed as vice-president.

Use of Aerial Photography Speeds Mapping Program

USE OF AERIAL photography in the current topographic mapping of Cuyahoga County, Ohio, is permitting notable reductions in time and costs, according to G. Brooks Earnest, M. ASCE, professor of engineering surveys at the Case Institute of Technology and consulting director of the Cleveland Regional Geodetic Survey.

Announcing completion of the first eight map sheets of the 450-sq mile area by the Aero Service Corp., of Philadelphia, Professor Earnest stated that this is "the first use of modern aerial methods in metropolitan mapping, which meets the usual city mapping specifications. Using previous plane table methods," he added, "we would need 150 years to map Cuyahoga County adequately, at a cost of approximately $3,330,000. The work can be done by aerial methods at less than half this cost, within three years' time."

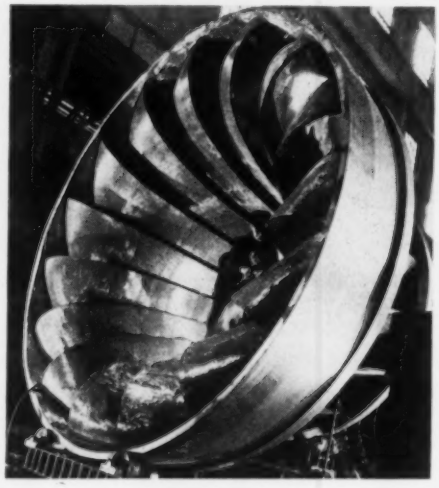
The mapping program is expected to provide up-to-date information for zoning, solution of traffic and sewage problems, and project planning, including a proposed freeway. Sponsoring agencies are the Ohio Department of Highways, the County of Cuyahoga, the City of Cleveland, the Cleveland Metropolitan Park Board, and seven suburbs.

February Steel Output Reaches New Peak

WITH AN APPROXIMATE output of 7,430,000 tons of steel for February, the industry established a new production record for the month, according to a recent release of the American Iron and Steel Institute. It was the second month of steel production at a new peak, the January output exceeding 8,000,000 tons for the first time in history—a tonnage equivalent to an annual output of about 96,500,000 tons of ingots and steel for castings. Production for these two months nearly equaled the entire 1948 output of Great Britain.

Another production record was established as of February 28 with completion of the seventh consecutive week of operation at 100 percent of rated capacity or better. Such a high rate of activity has been equaled only once before in the history of the industry—in the war months of September and October 1943. However, production for this war period was 660,000 tons lower than the 12,959,000 tons of raw steel produced in the seven-week stretch beginning January 17 of this year.

Huge Turbine Constructed for Wilson Dam



VANES OF CAST-STEEL FRANCIS-TYPE WATER WHEEL RUNNER for first of four additional 35,000-hp, 92-ft head hydraulic turbines, now under construction in Allis-Chalmers shops for Wilson Dam powerhouse, are smoothed by portable grinder. Runner will have finished weight of 95,000 lb. New turbines will bring to 18 total number of units at Wilson Dam, part of TVA system. Photo through courtesy of Allis-Chalmers.

Construction Safety Program Cuts Building Costs

A CONSTRUCTION SAFETY program, put into effect in building the nation's first peacetime atomic pile at Brookhaven National Laboratory, has saved the government more than $200,000 in liability and compensation insurance costs, according to Wells N. Thompson, Assoc. M. ASCE, vice-president of the H. K. Ferguson Co., in charge of building the project. Although 2,000 men were employed at peak periods and much heavy construction equipment was used, there have been no fatalities or serious accidents since the inception of the project almost two years ago, Mr. Thompson reports.

The safety program used on the project includes: (1) Devising safest construction methods with engineers and field workers in advance of actual work; (2) regular field inspections to eliminate unsafe conditions and hazardous storage of materials; (3) explaining safety measures to new workers; (4) encouraging the use of protective equipment, such as construction helmets and steel-capped shoes with non-skid soles; (5) an incentive system in which crafts compete against each other for the best safety records; and (6) a well-staffed and equipped dispensary.

ASCE Members Elected ACI Officers for 1949

NEW OFFICERS OF the American Concrete Institute, installed during the recent 45th annual convention of the organization in New York City, include Herbert J. Gilkey, M. ASCE, head of the department of theoretical and applied mechanics at Iowa State College, as president, and Harry F. Thomson, former ASCE Director, and president of the General Material Co., St. Louis, Mo., as vice-president.

Other members were among those honored for outstanding technical papers in an award session. The Leonard C. Wason Medal for "the most meritorious paper" was presented to Frank H. Jackson and Harold Allen, M. ASCE, and the ACI Construction Practice Award went to Raymond E. Davis and E. Clinton Jansen, Members ASCE, and W. T. Neelands for their paper on "Restoration of Barker Dam" in the February 1948 issue of CIVIL ENGINEERING.

Wide uses for light-weight concrete mixes in the insulation of buildings were suggested by Ralph W. Kluge, Assoc. M. ASCE, associate professor of structural engineering at Purdue University, in an address during the technical sessions. Professor Kluge presented a digest of the findings of a Bureau of Standards investigation on the properties of selected light-weight aggregates and of concrete made from such materials. ASCE members J. J. Hogan and E. B. Oberly, appearing in a Portland Cement Association panel, discussed studies of design details for architectural concrete.

More than 500 engineers attended the four-day meeting.

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Corps of Engineers Warns of Flood Threat to Western States

SERIOUS FLOOD THREATS attributable to the past winter's abnormal snow cover now face the Missouri River Basin and numerous other areas of the West, according to Lt. Col. H. C. Gee, M. ASCE, Deputy Chief of Civil Works for Flood Control. Testifying for the Chief of Engineers at a hearing before the Senate Committee on March 4, Colonel Gee stated that 40,000,000 acre-ft of water now present on the Missouri River Basin in the form of snow cover must run off, evaporate, or be absorbed in the ground during the coming spring break-up. It is estimated that approximately 25,000,000 acre-ft of this amount will run off, the temperature sequence and spring rainfall determining whether or not serious floods occur.

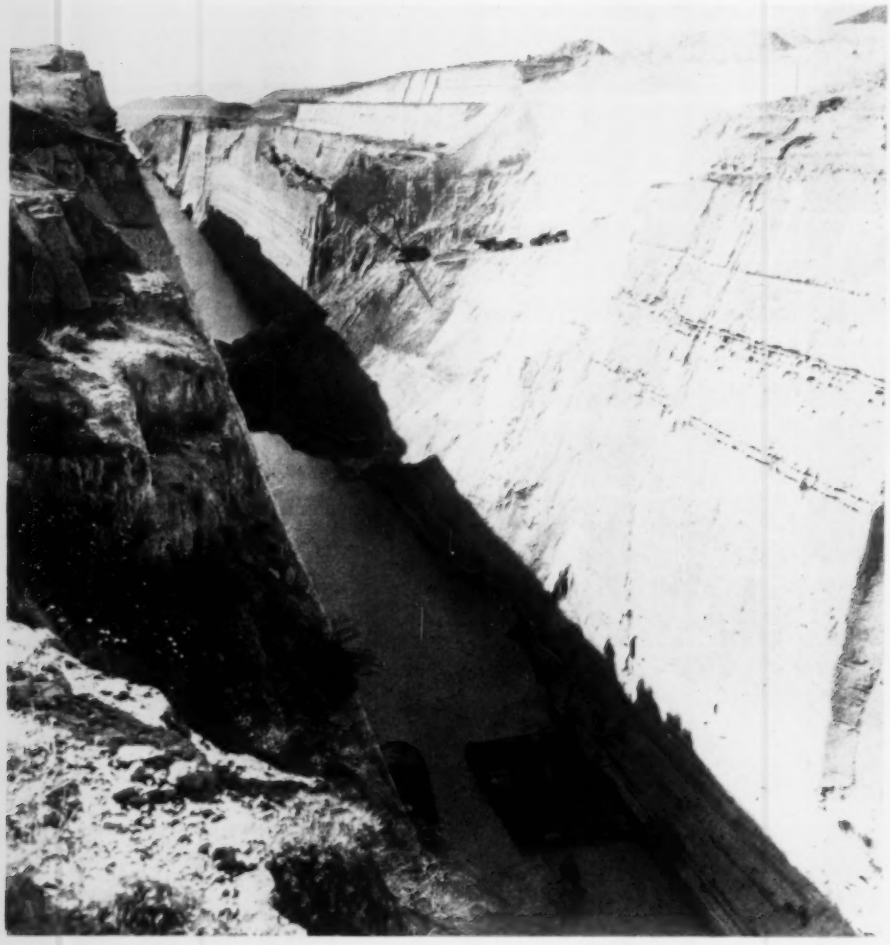
In numerous localities in the Missouri River Basin, the snow cover is now being coverted into ice-jam flooding, Colonel Gee said. An ice-jam 70 miles in length was formed on the main stem of the Missouri in the vicinity of Fort Leavenworth, Kans., and ice-jam floods have been reported on the Platte, the Elkhorn, and other tributaries of the Missouri in the states of Iowa, Nebraska, and Missouri. These floods provide the first indication of the type of spring runoff that may be expected in that watershed.

Other areas that are being closely watched for floods include the Columbia River Basin, the Great Basin in Nevada and Utah, the Colorado River Basin, and the Rio Grande Basin of Colorado and New Mexico. In certain areas of the Rio Grande watershed, the water content of the snow cover is the greatest ever recorded since snow surveys began. In the states of Nevada, Utah, Arizona, California and the parts of Wyoming, Colorado, and New Mexico lying west of the Continental Divide, the heavy snow cover is likely to produce flash floods such as that occurring last year in the Columbia River watershed, which produced the near-record flood in Washington and Oregon.

According to Colonel Gee, the run-off situation in the Upper Mississippi Valley is about normal. However, the lower Mississippi Valley, which includes the portion of the river from Cairo, Ill., at the mouth of the Ohio to the Gulf of Mexico, has been in flood for almost a month, and it is expected that flood heights will continue for some time to come.

Authorized by law to repair and restore levees and other flood-control works that are weakened or destroyed by floods, the Corps of Engineers in its testimony before the Senate Committee strongly supported President Truman's recent request to Congress for a $25,000,000 flood-control appropriation, to be used to meet any emergency that may arise during the coming spring break-up. The President's message called for an emergency flood fund of $22,500,000 to be added to the $2,500,000 already in the Deficiency Bill before the Senate.

Corinth Canal Restored to Service After War Demolition



PROCESS OF REMOVING SLIDE FROM CORINTH-ATHENS CANAL, near Corinth, Greece, resulting from demolition by Germans in retreat in 1943, is shown in view made in May 1948. Tunneling into 200-ft-high limestone banks of canal, Nazis blasted 800,000 cu yd into channel. They also destroyed steel bridges across canal, and dumped into channel 8 locomotives, 1,300 box cars, and 1,800 tons of scrap iron and railroad rails, booby-trapping the whole with mines. Most of material removed was trucked up steep face of slide. Project of clearing canal and replacing bridges, under American Military Government, was finished in July by Steers-Grove, New York contractors. From information by Knute A. Johnston, U.S. Engineers, AMG.

Gas Pipeline from Texas to New York Authorized

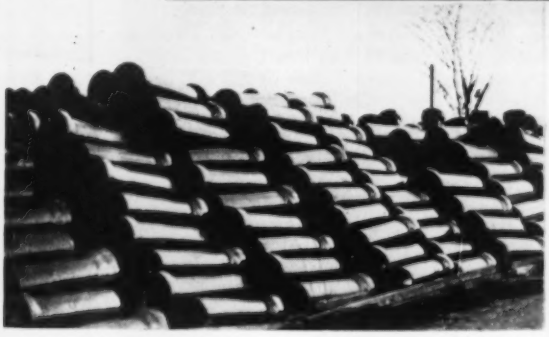
AN 1,800-MILE PIPELINE for the transmission of natural gas from Mercedes, Tex. to New York City, recently authorized by the Federal Power Commission, will have a daily capacity of 325,000,000 cu ft. In addition to this pipeline, which will constitute the largest single project of its type yet undertaken, projected lines connecting the South and Southwest with the Northeast are expected to provide a daily capacity of over a billion cubic feet. Applications have been filed with the Federal Power Commission for construction of the proposed New England line as far as Buffalo.

According to the annual pipeline review of the *Oil and Gas Journal*, almost 70,000 miles of pipe are already in use for transportation of natural gas in the United States and construction of 19,000 additional miles within the next few years is planned. The present total capacity of 2,225,000,000 cu ft a day is almost three times the amount piped into the Northeast in 1946.

Large Hangar to Be Built at International Airport

IMMEDIATE CONSTRUCTION OF a fifth permanent hangar at New York International Airport at a cost of more than $1,500,000 has been authorized by the Port of New York Authority. The new hangar, to be built by the Stock Construction Co., will be located adjacent to two similar hangars already under construction by the company. Each of the hangars will be of steel-arch construction, with 300-ft spans and able to accommodate four of the new Boeing Statocruisers. Completion is scheduled for early in 1950.

Colorful Baton Rouge is spending six million dollars to make its sewer system as modern as the city it serves. Vitrified Clay Pipe has been specified for this huge project. 250 miles of new sewers, using clay pipe up to 36", are going in. This includes 10,000 house connections, most of which are 4" and 6" Clay Pipe. Three contractors on this huge project are Sullivan, Long and Hagerty of Bessemer and Birmingham, Ala.; E. L. Dalton & Co. of Dallas, Texas; Forcum-James & Co. of Baton Rouge and Dyersburg, Tenn.



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C-449-1

Excavation for U.N. Headquarters Completed

COMPLETION OF EXCAVATION operations at the site of the United Nations permanent headquarters on the East River in mid-town Manhattan, a month ahead of schedule, has just been announced by Fuller-Turner-Walsh-Slattery, Inc., corporation of construction companies in charge of the work. More than 150,000 cu yd of earth and 65,000 cu yd of bedrock have been excavated from the 17-acre tract since the inception of the work in September 1948. Much of the better material has been stockpiled on the lot for future use as backfill, and the remainder is being used for fill at Randall's Island and La Guardia Field. Some 30,000 cu yd of poorer material was loaded on barges for dumping.

Because of the network of sewers exposed during the excavation, which reached a depth 31 ft below street level to a general grade of 4 ft above mean sea level, extreme care had to be exercised during blasting operations. All sewage pipes crossing the site were strengthened by supports and their operation maintained during blasting. The Interborough Rapid Transit ventilation shaft also crossing the area was underpinned and protected to rock during blasting.

Work has already been started on pouring the mass concrete foundations, which will vary in thickness according to the weight and height of the structure to be supported. The Secretariat Building (shown in artist's sketch in the March issue) will be supported by 10-ft-square sections resting on bedrock at an average depth of 13 ft below sea level. In the filled-in areas, where depth to bedrock varies from 20 to 90 ft, steel piling driven to bedrock will support the foundations of the General Assembly and the meeting hall area.

Concrete Pipe Association Addressed by ASCE Members

LOADS AND SUPPORTING strengths of rigid pipe conduits were discussed by ASCE Members W. J. Schlick and M. G. Spangler, research professors of civil engineering at Iowa State College, in key addresses presented at the 41st annual convention of the American Concrete Pipe Association, held in Richmond, Va., March 10–12. Professor Schlick's treatment of the subject covered "Basic Theories and Relationships," and Professor Spangler dealt with the topic, "Present Knowledge of Certain Factors Required in Design."

Other technical speakers were Lorenz G. Straub, M. ASCE, director of the St. Anthony Falls Hydraulic Laboratory at the University of Minnesota, who discussed "Practical Hydraulics of Highway Culverts"; Carl F. Izzard, Assoc. M. ASCE, highway research engineer for the Public Roads Administration, who covered the subject of "Trends in Estimating Rates of Runoff"; and E. F. Kelley, chief of the Division of Physical Research of the PRA, whose topic was "Some Unsolved Problems Related to Concrete Pipe."

As president of the Association, J. A. Dunn, Assoc. M. ASCE, presided at the three-day program of technical and business sessions, social events, and excursions that attracted an attendance of 275. The organization's list of directors includes Harry S. Price, Jr., and D. A. Dunkle, Associate Members ASCE. Howard F. Peckworth, M. ASCE, is managing director of the American Concrete Pipe Association.

Engineers Reserve Unit Affiliates with St. Louis Engineers Club

AFFILIATION AGREEMENT FOR FORMATION OF Engineer Brigade in Army Organized Reserves is signed in Engineers' Club of St. Louis by co-sponsoring groups—Upper Mississippi Valley Division of Corps of Engineers and St. Louis Engineers' Club. Photo shows (seated, left to right) Col. F. H. Boucher, Missouri Senior Army Instructor, Organized Reserves; Brice R. Smith, M. ASCE, president of Engineers' Club; and Col. Clark Kittrell, M. ASCE, Division Engineer, Upper Mississippi Valley Division. Standing, left to right, are Col. Joseph E. Vollmar, Assoc. M. ASCE, Engineer Reserve, Commanding Officer of newly affiliated Engineer Brigade; Col. D. W. Heiman, assistant to Division Engineer; and Walter E. Bryan, secretary of Engineers' Club.

Record-Breaking Production of Clay Products Reported

MORE THAN SEVEN billion brick equivalents were turned out by the brick and tile industry of the country during 1948, the greatest production year since 1930, according to the Structural Clay Products Institute. The output of brick alone was 16 per cent greater than in 1947, with total brick production estimated at 5,845,000,000 brick by the Department of Commerce. The output of hollow facing tile, glazed and unglazed, reached an all-time peak of 335,000,000 brick equivalents, marking a 12 percent production increase over 1947 for this relatively new structural masonry material.

The 1949 clay products forecast is for continued record-breaking output to meet construction needs. Approximately 50 percent of the current brick and tile production is available in the new modular sizes, which permit cutting construction costs.

Plans for Midwest Power Conference Are Announced

SUBJECTS PERTAINING TO the production, transmission, and consumption of power are scheduled for discussion at the 11th annual Midwest Power Conference, to be held at the Sherman Hotel, Chicago, April 18–20. The conference will be sponsored by the Illinois Institute of Technology, with the cooperation of seven Mid-Western universities; local sections of the four Founder Societies and the American Institute of Chemical Engineers; the Western Society of Engineers; the Engineers' Society of Milwaukee; and the National Association of Power Engineers.

Inquiries should be addressed to Edwin R. Whitehead, Conference Secretary, at the Illinois Institute of Technology, 3300 Federal Street, Chicago 16, Ill. A copy of the published Proceedings will be mailed to each registrant without charge. Additional copies will be available at $3 each.

"FLEETWELDERS" ELIMINATE ARC BLOW ...increase welding speed 10%

By J. K. GANNETT
Vice President in charge of Engineering and Research,
The Austin Company,
Cleveland, Ohio

J. K. Gannett

The solid, uniform welds required in our heavy structural work are now being made easier and at lower cost with AC arc welding. By eliminating the restrictions of arc blow in the construction of heavy structural weldments like the roof truss shown, our fabricating shop is today able to take full advantage of higher welding currents with resulting substantial increases in welding speeds.

Structural members like the jack truss shown in the photographs are shop fabricated from wide flange beams and from plate. Component members are first positioned accurately for close fit-up and tack welded. One side is then partially welded with fillets of ¼" "Fleetweld 7" electrode using 500-amp. Lincoln "Fleetwelder" AC arc welders.

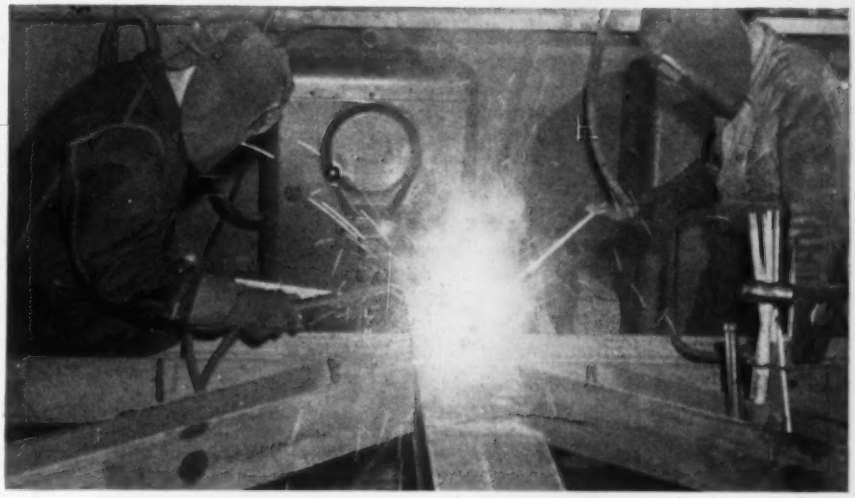


Fig. 1. *Arc welding diagonals to chord with the 500-amp. Lincoln "Fleetwelder" AC welders at the structural fabrication shop of The Austin Company.*

After the initial side welds are made, the truss is placed in an upright position as shown in Fig. 2 and continuous welds completed around each member, framing into the lower chord. The truss is then flopped over and similar welding is done for the members framing into the other chord. This procedure permits us to use fast downhand welding techniques on all connections and assures us solid, high quality welds on all joints at the lowest fabricating cost.

Using the AC "Fleetwelders," thus eliminating arc blow, allows our operators to increase their current to over 300 amperes with no difficulty in maintaining a steady, constant arc at all times. Increased amperage, combined with steady, uninterrupted operation, has cut our welding time about 10%.

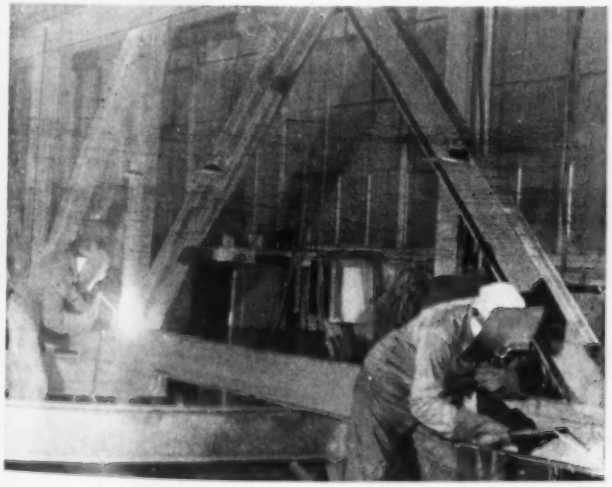


Fig. 2. *Fabricating all-welded 40-ft. jack truss for factory building framework. Top and bottom chords are 10"-21WF beams; diagonals are 8"-17WF beams. Welds are downhand, single pass, ⅜" fillets.*

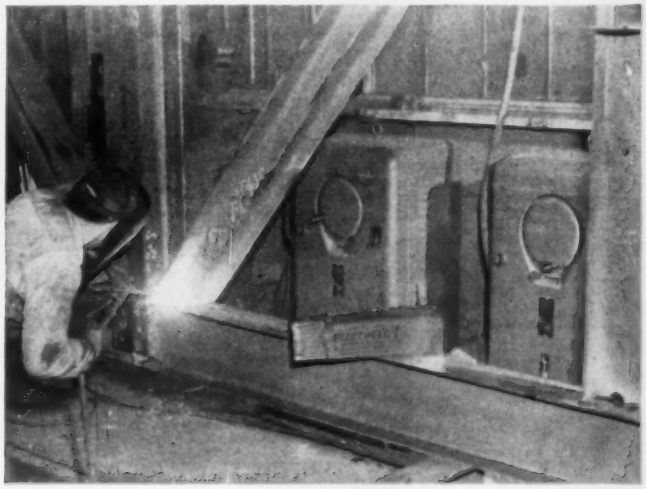


Fig. 3. *Finishing all-around welding of diagonal to bottom chord. Weld is made with single pass ¼" diameter "Fleetweld 7" electrode. Welding current is 310 amps.*

The above is published by **THE LINCOLN ELECTRIC COMPANY** *in the interests of progress.*
For further information on "Fleetwelders," write for Bul. 366, The Lincoln Electric Company, Dept. 142, Cleveland 1, Ohio.

Hoover Commission Majority Recommends Enlarged Department of Interior

THE COMMISSION ON Organization of the Executive Branch of the Government, headed by Herbert Hoover, Hon. M. ASCE, reported to Congress on March 15 its majority opinion that the Department of Interior should be enlarged to include flood control and rivers and harbors functions of the Corps of Engineers, and the construction of public buildings of the Federal Works Administration, the Bureau of Reclamation remaining in the Department.

Board of Impartial Analysis Featured

Reports of several task forces aided the Commission in its decision. The conclusions of two of them, namely, the "Public Works" and "Natural Resources" forces, were reported in the March issue of CIVIL ENGINEERING. These two forces recommended that the Department of Interior be replaced by a new department, variously named "Public Works," "Natural Resources," or "Works and Resources." The majority of the Commission took the view that the Department of the Interior should be retained in name and be given more clearly the mission of development of subsoil and water resources, and the management of the construction of other major public works.

Accepting the recommendation of its task force on Public Works, the Commission recommends the creation of a Board of Impartial Analysis for Engineering and Architectural Projects to review and report to the President and the Congress on the public and economic value of projects proposed by the Department, and upon the technical merits of the projects. According to the majority report of the Commission, this Board would be appointed by the President and be included in the President's Office.

Reorganization envisaged by the Commission involves transfer of certain agencies from the new Department and the incorporation of other agencies within it. Indian Affairs, Land Management and Commercial Fisheries would go to other Departments. From the Corps of Engineers would be transferred its flood control, and rivers and harbors functions; from the Federal Works Agency would be transferred Community Services and Public Building Construction; and from other agencies of government certain major construction, such as hospitals and civilian airport construction, except when carried on by grants-in-aid programs.

Another Hoover Commission report recommended that the Public Roads Administration be transferred from FWA to the Department of Commerce.

Sharp dissent is registered by two Commissioners, McClellan and Manasco, to transferring the civil activities of the Corps of Engineers to the reorganized Department of Interior. They averred that stripping it of its civil functions in peacetime would emasculate completely the Corps of Engineers and be a crippling blow to national defense. A majority of the Commission believes, however, that consolidation is the only remedy to inherent conflicts between the most efficient operation of storage dams for the purpose of flood control; of dams used for the generation of electric power; and of reservoirs for the storage of water for irrigation. "Only continued friction," the report concludes, can result "with the Reclamation Service in control of one function of some reservoirs, and Army Corps of Engineers in charge of others."

The services to be included in the proposed reorganization of the Department of the Interior are shown in Fig. 1, and the agencies to be absorbed by each are listed below.

Copies of the report to Congress of the Commission on Organization of the Executive Branch of the Government (dated March 1949) can be obtained from the Government Printing Office, Washington.

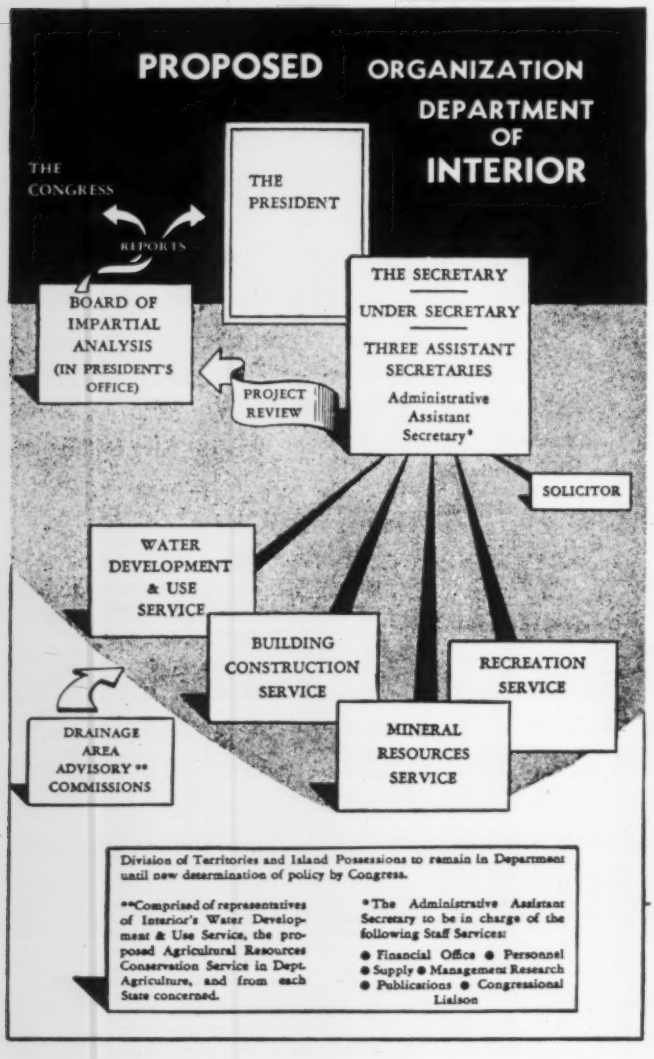

PROPOSED ORGANIZATION DEPARTMENT OF INTERIOR
THE CONGRESS
REPORTS
THE PRESIDENT
BOARD OF IMPARTIAL ANALYSIS (IN PRESIDENT'S OFFICE)
PROJECT REVIEW
THE SECRETARY
UNDER SECRETARY
THREE ASSISTANT SECRETARIES
Administrative Assistant Secretary*
SOLICITOR
WATER DEVELOPMENT & USE SERVICE
BUILDING CONSTRUCTION SERVICE
RECREATION SERVICE
MINERAL RESOURCES SERVICE
DRAINAGE AREA ADVISORY ** COMMISSIONS
Division of Territories and Island Possessions to remain in Department until new determination of policy by Congress.
**Comprised of representatives of Interior's Water Development & Use Service, the proposed Agricultural Resources Conservation Service in Dept. Agriculture, and from each State concerned.
*The Administrative Assistant Secretary to be in charge of the following Staff Services:
● Financial Office ● Personnel ● Supply ● Management Research ● Publications ● Congressional Liaison

FIG. 1. REORGANIZATION OF Department of Interior recommended by Hoover Commission emphasizes development of subsoil and water resources, and management of construction of major public works. Board of Impartial Analysis, appointed by President, would review projects recommended by Department for timeliness, public and economic value, and technical merit.

WATER DEVELOPMENT AND USE SERVICE

Bureau of Reclamation,
Rivers and Harbors, and Flood Control (Army)
Division of Power Flood Control
Bonneville Power Administration
Southwest Power Administration

BUILDING CONSTRUCTION SERVICE

Preparation of plans, awarding of contracts, supervision and inspection of major construction, but no operation after construction.

Public Buildings and Community Services of Federal Works Administration.

Major Land Construction for Coast Guard

Hospital, and Civilian Airport Construction except under grants-in-aid projects.

MINERAL RESOURCES SERVICE

Geological Survey Bureau of Mines
Division of Oil and Gas
Leasing of Mineral Lands, and Administration of Mineral Leases
Investigations of Natural Gas Resources
Government Tin Smelter, Texas City
Advisory function to Federal agencies dealing with minerals

RECREATION SERVICE

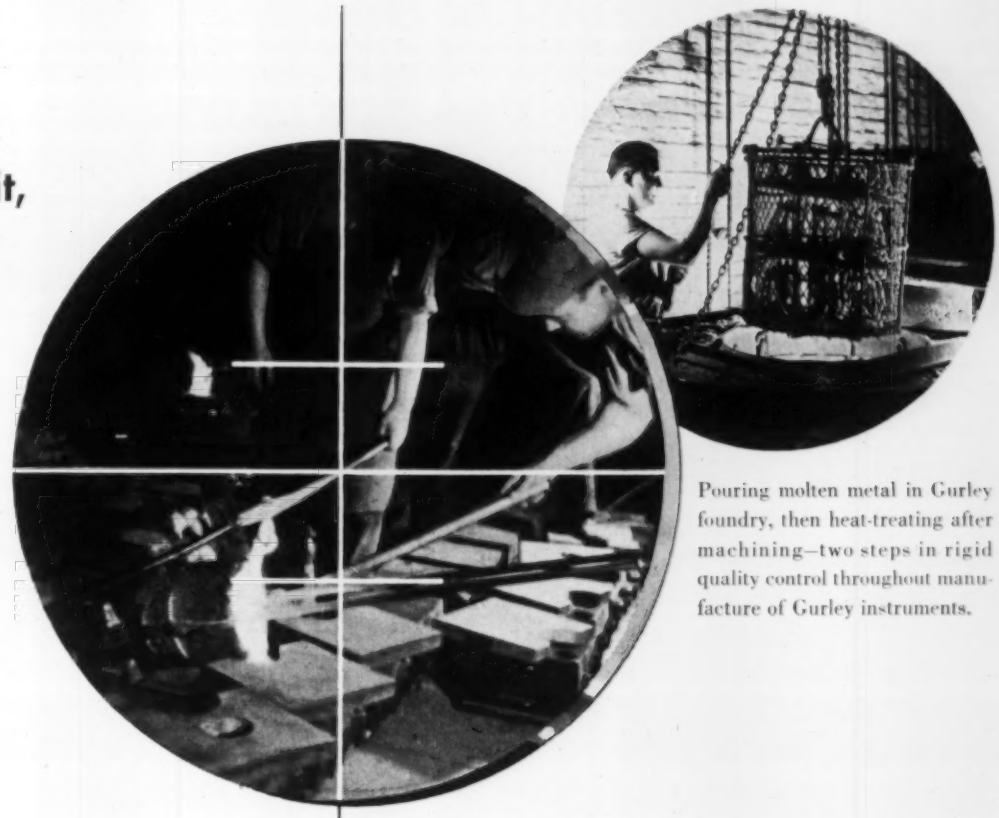
Public Parks and Monuments
Wildlife and Game Fishing

COMMISSION ON ORGANIZATION OF THE EXECUTIVE BRANCH OF THE GOVERNMENT

Herbert Hoover, Hon. M. ASCE, Chairman
Dean Acheson, Vice-Chairman

A. S. Fleming	John L. McClellan
James Forrestal	James K. Pollock
George H. Mead	Clarence J. Brown
George D. Aiken	Carter Manasco
Joseph P. Kennedy	James H. Rowe, Jr.

While you're looking through a transit, take a look at what's behind it



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Construction Roundup

From the Construction Industry Information Committee—Washington, D.C.

UNPRECEDENTED HOUSING GAINS made in the United States since 1940 are reported by the Construction Industry Information Committee in its latest economic study.

The study shows that the public has been successful in obtaining better housing—and that the building industry has delivered. Purchasing power and production have once again performed according to the typically American formula to bring about a tremendous upgrading of housing standards.

Far more families are living in well-equipped houses in good repair than ever before. Far fewer families are living in substandard housing than at any time in the past. There has been an enormous addition to the housing supply. There is more dwelling space per family and per person. The proportion of married couples living doubled up is smaller than in 1940.

The contribution made by the sheer quantity of additional dwelling units fed into the supply through construction activity is enormous. While the study shows that there still is room for great improvement in housing, it states that the need is being met rapidly. The nonfarm housing supply has been expanded 22 percent since 1940, or at about one-fourth more than the rate of the nonfarm population increase. The tremendous total of 6.7 million dwelling units has been added in nonfarm areas—cities, suburbs, and small towns, where the housing situation has been most acute. Of these 4.9 million were new houses and apartments, and 1.8 million were created by remodeling existing buildings to provide additional dwelling units. Allowing for various other additions to, and withdrawals from, the supply, we now have a net increase of 6.6 million houses and apartments over 1940.

It is not such a paradox that we have more housing room than before the war and yet housing is harder to find. That is because we are using up more of the available supply, and so we still do not have as many vacancies in proportion to the total number of dwellings as we had in 1940. But we are catching up on this. The total vacancy rate is somewhat less than 5 percent now, compared with 6.5 percent in 1940.

It is remarkable that such housing gains have been made in the 1940's—a period marked by curtailment of house building during the war, shifts of population to meet the requirements of war production, the abnormally high rate of new family formation since the war, and postwar inflationary conditions.

No one will gainsay that there is still much to be done to meet the demands and needs ahead in housing, but never before has there been such a record of accomplishment to serve as a basis of further undertaking by the construction industry.

Utah University Sponsors Tenth Highway Conference

WIDE COVERAGE WAS given current highway, airport, and bridge construction problems at the recent tenth annual highway engineering conference at the University of Utah. The three-day program, sponsored jointly by the Utah State Road Commission and the Department of Civil Engineering at the university, was directed by A. Diefendorf, M. ASCE, head of the department. Assisting him as associate conference directors were civil engineering staff members H. S. Carter, M. ASCE, and R. L. Sloane, Assoc. M. ASCE.

Technical sessions on pavement design and stabilization featured papers by Bernard E. Gray, M. ASCE, general manager of the Asphalt Institute, New York, and Associate Members V. J. Brown, director of the publication, *Caminos y Calles*, and consulting editor of *Roads and Streets*, Chicago; A. W. Johnson, engineer of soils and foundations for the Highway Research Board, Washington, D.C.; A. A. Anderson, manager of the Highways and Municipal Bureau of the Portland Cement Association, Chicago, Ill.; and Professor Sloane.

F. W. Panhorst, M. ASCE, bridge engineer for the California Division of Highways, discussed "False Bridge Economics" in a session on highway and bridge costs, and John M. Server, editor of *Western Construction News*, San Francisco, spoke on the subject, "The World's Longest Bridge Is Obsolete—Proposals for a Second San Francisco Bay Crossing," at another session.

Presiding officials included ASCE Members Ezra C. Knowlton, W. W. Clyde, and Professor Carter.

Building Costs Reduced by Modular Coordination

THE INCREASING COOPERATION of architects, manufacturers of building materials, and government agencies in the adoption of modular coordination was cited as an important step in helping to overcome "the housing shortage, reduce building costs, and make construction more efficient," in a recent release of the American Institute of Architects. Developed by the American Standards Association Committee A62, which was organized under sponsorship of the AIA and the Producers' Council, the modular standards have recently been adopted by the Housing and Home Finance Agency.

Specific accomplishments in the field of modular coordination cited by the cooperating groups include reduction of 30,000 types and sizes of metal windows to 300, and drastic simplification of the manufacture of other types of windows, doors, kitchen cabinets, and brick and other masonry products. Production is easier, smaller inventories can be maintained, and construction savings of from 5 to 15 percent have been attained.

Since the 4-in. standard can be employed profitably in combination with more conventional techniques, builders do not have to wait until all manufactured products incorporate it. Techniques of testing and building the modular house are being conducted by the Small Homes Council at the University of Illinois.

Large Western Projects Announced by U.S.B.R.

AMONG FORTHCOMING WESTERN construction projects, listed by the Bureau of Reclamation in its *Advance Construction Bulletin* for March 1, under head of "Bid Calls Expected This Month," are the following:

DELTA-MENDOTA CANAL
Central Valley Project, California

Location: Near Los Banos, Calif.
Work: Construction of earthwork, concrete lining, and structures for about 17 miles of Delta-Mendota Canal, 4,200 cfs capacity.

Excavation for canal	5,500,000 cu yd
Excavation for structures, drains, dikes, and channels	261,000 cu yd
Trimming foundation for concrete lining	1,017,000 sq yd
Concrete in lining and structures	127,000 cu yd
Furnishing and placing reinforcing steel	2,067,000 lb
Installing gates and hoists	193,000 lb
Time Allowed for Completion:	790 days

DAM REHABILITATION
Deschutes Project, Oregon

Location: Near Prineville, Ore.
Work: Rehabilitation of Ochoco Dam, spillway, and outlet works. The dam is an earthfill structure about 125 ft high and 970 ft long.

Excavation (all classes)	241,300 cu yd
Earthfill in dam	40,000 cu yd
Sand and gravel fill in dam and abutments	103,000 cu yd
Riprap upstream slope of dam	30,000 cu yd
Rockfill downstream slope of dam	100,000 cu yd
Furnishing and laying 4- to 18-in. diameter sewer-pipe drains	5,220 ft
Concrete	2,500 cu yd
Furnishing and placing reinforcing steel	251,000 lb
Time Allowed for Completion:	500 days

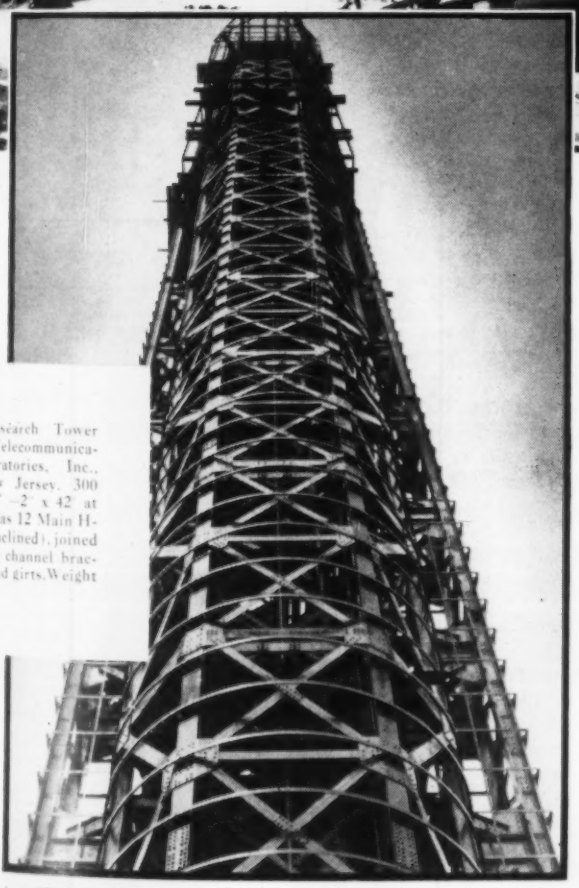
WINCHESTER WASTEWAY
Columbia Basin Project, Washington

Location: Near Winchester, Wash.
Work: Construction of earthwork and structures for the 15-mile-long Winchester Wasteway, 4,200 cfs capacity.

Excavation (common)	2,347,000 cu yd
Excavation (rock)	42,600 cu yd
Concrete in structures	9,000 cu yd
Furnishing and placing reinforcing steel	1,150,000 lb
Time Allowed for Completion:	600 days

Experimental Talking Tower

FABRICATED AND ERECTED BY AMERICAN BRIDGE COMPANY



...tory Research Tower ...Federal Telecommunica... ...Laboratories, Inc., ...ley, New Jersey. 300 ...high. 38' – 2" x 42' at ...base, it has 12 Main H- ...ams (4 inclined), joined ...angle and channel brac- ...beams and girts. Weight ...tons.

View showing completed project. Laboratory buildings were erected for Federal Telecommunications Laboratories, Inc. Buildings 1 and 2 (in background) Louis S. Weeks, Architect—George A. Fuller, General Contractor. Buildings 3 and 4 and Tower (in the foreground) Giffels and Vallet, Inc., Engineers—L. Rossetti, Architect—George A. Fuller, General Contractor. All structural steel fabricated and erected by American Bridge Company.

● Improved television. Multi-channel communication links. FM mobile communications systems. Radar aids to aerial navigation. These are a few of the projects already begun in the research tower and laboratory buildings which American Bridge Company fabricated and erected for subsidiaries of International Telephone and Telegraph Corporation in Nutley, New Jersey.

The same care, the same service, the same knowledge American Bridge used on this and many other projects are available to you whatever the size or complexity of your structural or erection requirement.

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AMERICAN BRIDGE

UNITED STATES STEEL

R. Robinson Rowe, M. ASCE

"WE HAVE," SAID Professor Neare, "a ratty problem before us, one which is at once *rat*ional and *rat*iocinative. Before asking Guest Professor Parker Piper to unravel the problem, it should be understood that he is not related to Pied Piper, that his interest in rats is ephemeral, and that he piped not rats but water, from Parker, not Hamelin."

"And I'm all business, Noah, so I'll skip the joke about the demok rats and the burok rats and ask Joe how many rats there must have been if all the routes thru the building frame couldn't be used exactly in a month of nightly forays until 1952."

"Three," said Joe Kerr. "You said there was a Chief Rat, a G-2, and a G-4. If one of these was wacky, they could conceivably increase to ten million in three years and I'm betting that there aren't more routes than that in any building."

"You're quibbling," complained Professor Parker. "I want the number of rats that participated in the foraging foray."

"Which is more than ten million," exclaimed Ken Bridgewater. "Obviously the year 1952 differs from intervening ones only by having a 29-day month, so you want us to design a building for which the number of different routes on the frame from lower NE to upper SW corner is a multiple of 29. Therefore, by permutations, if N = number of routes, R = number of rats, and h = height of building in stories of 4 bays wide by 10 bays long, we have:

$$N = 29R = \frac{(14 + h)!}{4!10!h!} = 1001 \prod_{x=1}^{h} \frac{14 + x}{x} \quad \ldots\ldots (1)$$

Now h must be at least 15 stories to get a factor 29 in the numerator, and for h = 15, N = 77, 636, 318, 760, R = 2, 677, 114,-440 rats."

"Unnh-uh," objected Cal Klater. "That N is divisible by 30, and there are lots of 30-day months before 1952. Just make h = 16 stories and N will be divisible by 29 and not by 28, 30, or 31, making R = 5, 019, 589,-575 rats."

"That's right, Cal, but we can concede a little to Ken. For his number of rats, the foray can't be made until 1952; for your number of stories, the foray can't be made until 1952 by any number of rats. Anything to add, Noah?"

"Just one thing, Parker. Ken just whispered that for Cal's interpretation the next solution is a 105-story building and that the number of rats has 20 digits beginning 2041 . . . . I think myself that the building will fall down under the live load and impact of a traffic of 232,000 rats per sec at each terminus. A very fine test of our impractical imagination—thanks.

"Do you remember Hans Tuck who flew to the NW Pole nine years ago? Well, right now he's planning a non-stop daylight flight from the South Pole to the North Pole. If we suppose a spherical earth and neglect refraction and twilight, how fast a plane will Tuck need?"

[Guest Professor Parker Piper is Director Julian Hinds, who is setting up a sequel with one girder left out. Klaters and Bridgewaters were: Ed C. Holt, Jr., Richard Jenney, Homer W. Woodbury and John L. (Stoop) Nagle. Finalists of the Vermithon Handicap were Herman Soifer, Parker Piper, and Marvin A. Larson: since the latter in Fairbanks is handicapped by mail schedules, we can also acknowledge his solution to last December's literary problem.]

Meetings and Conferences

American Management Association. Gearing production to today's changing economic conditions will be discussed at the American Management Association's Spring Production Conference, to be held at the Waldorf-Astoria Hotel, New York City, April 12–13.

American Society of Mechanical Engineers. Oil and gas power will be the main topics of discussion at the 21st national conference of the American Society of Mechanical Engineers, at the Hotel Sherman, Chicago, Ill., April 25–29.

British Industries Fair. An atomic energy stand will be among the unusual features of the British Industries Fair, to be held at Earl's Court and Olympia, London, and Bromwich Castle, Birmingham, England, May 2–13.

Chamber of Commerce of the United States. Highlights of the 37th annual national meeting of the Chamber of Commerce, to be held in Washington, D.C., May 2–5, are the citizenship luncheon (May 2), the organization night dinner (May 3), and the annual dinner (May 5). All events will be held at the Hotel Statler.

College of Civil Engineers of Mexico. All main fields of civil engineering will be covered at the first international congress of civil engineers of Mexico, April 30–May 7. This conference is under the sponsorship of Señor Miguel Aleman, president of Mexico, with the cooperation of National University of Mexico, National Polytechnic Institute, and Association of Engineers and Architects of Mexico. For further information address Comision Organizadora, Plaza de la Republica 55-606, Mexico, D.F.

Forest Products Research Society. The third annual national meeting of the Forest Products Research Society is scheduled for the Civic Auditorium at Grand Rapids, Mich., May 2–4. An exhibit, held in conjunction with this meeting, will be open to industries engaged in the production, development, or utilization of forest products.

Instrument Society of America. Headquarters for the 4th spring meeting of the Instrument Society of America will be at the Royal York Hotel, Toronto, Canada, on May 12 and 13. For further information write to Richard Rimbach, national secretary, Instrument Society of America, 111 Wolfendale Street, Pittsburgh 12, Pa.

New York State Society of Professional Engineers. Industrial exhibit and symposium on the sources and control of pollution of the waters and beaches of New York State are features of the 22nd annual convention of the New York State Society of Professional Engineers, Hotel New Yorker, New York, N. Y., April 21–23.

Society of Automotive Engineers. National aeronautic and air transport meeting and aircraft engineering display of the Society of Automotive Engineers is scheduled for the Hotel New Yorker, New York City, April 11 through 14.

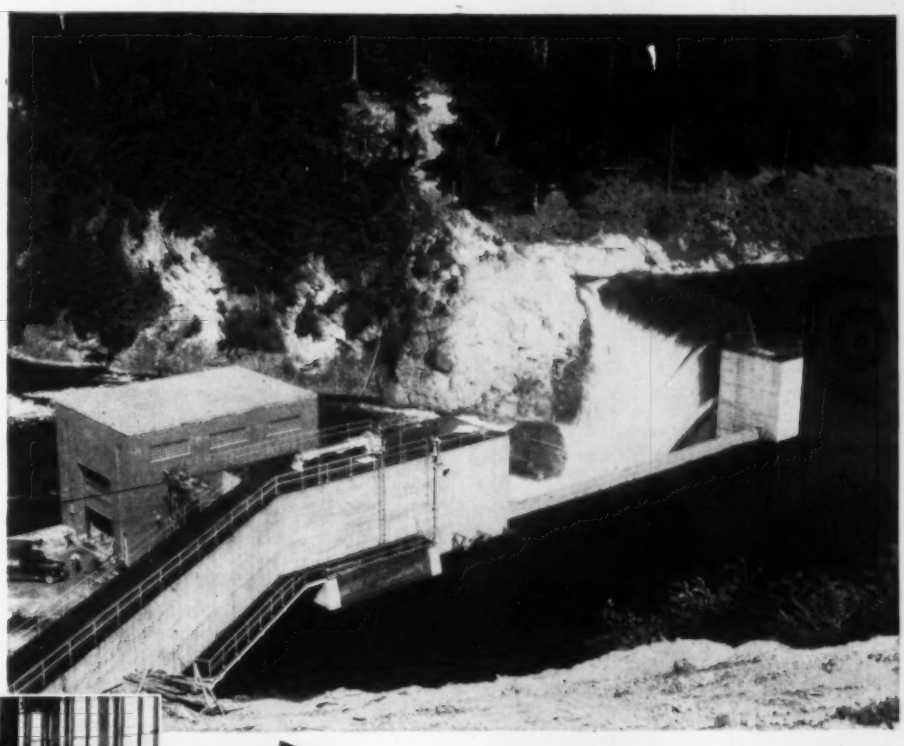
Society of Naval Architects and Marine Engineers. The spring meeting tour of the Society of Naval Architects and Marine Engineers in the western part of the United States will be held May 6 through 22.

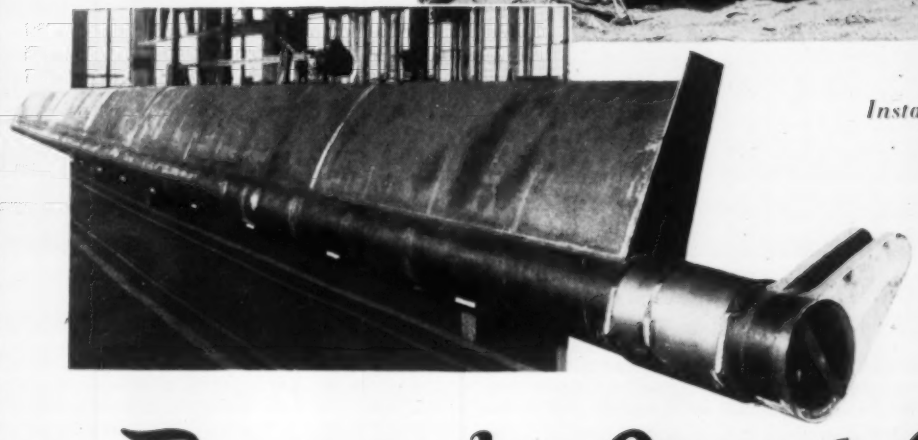
Western Metal Congress and Exposition. More than 100 papers on ferrous and nonferrous products are to be delivered at the Western Metal Congress and Exposition, to be held in the Shrine Convention Hall and Biltmore Hotel, Los Angeles, Calif., April 11–15.

Positions Announced

Arizona State Department of Health. Continuous recruitment for full-time permanent positions as Junior Sanitary Engineer ($240–280); Sanitary Engineer ($280–320); and Senior Sanitary Engineer ($375–450). Information and application forms from Supervisor, Arizona Merit System Council, 30 West Adams Street, Room 104, Phoenix, Arizona.

U.S. Civil Service Commission. Applications for engineer positions with various federal agencies in Washington, D.C., and vicinity, are announced by the U.S. Civil Service Commission. Entrance salaries range from $2,974 to $5,905 a year. The maximum age limit for jobs at $2,974 is 35; for other jobs, 62. No written test will be required for any of the positions. To qualify, applicants must have had education or experience in engineering, or a combination of both. Announcements and application forms may be obtained from the U.S. Civil Service Commission, Washington 25, D.C. Applications for positions at $2,974 will be accepted until further notice; for the higher paying positions until June 30.





Installation and shop views of Bascule type Crest Gates

Bascule Crest Gates *by* SMITH

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This unusual gate is primarily designed and built in span and height for installations requiring greater spillway capacity or increase in pond storage above existing dam heights. Write us for data regarding our full line of gates and hoists.

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NEW IN Education

MIT to Conduct Solar Heating Experiments

STUDIES TO DETERMINE to what degree the sun can compete with conventional methods of heating will be made at Massachusetts Institute of Technology, according to a recent announcement from the Institute. Investigations will be carried out in a specially built four-room house, equipped with a heat collector in the roof and an instrument room, in which MIT engineers will measure the heat absorbed from the sun and that lost from the house during sunless days.

VIEW SHOWS SOUTH EXPOSURE of house recently built by Massachusetts Institute of Technology in Cambridge, Mass., for experiments in solar heating. Glass areas of heat collector are visible on roof.

Water, warmed by the sun in a special flat plate collector located on the roof, is used for storing and distributing heat. After the water has been warmed by the sun, it is pumped into an insulated storage tank of 1,200-gal capacity, in which it is held during sunless hours when the heat is radiated from a panel in the ceiling. It is estimated that, during an average January day, the water in the storage tank will rise in temperature a few degrees more than it falls at night, thereby slowly storing heat for use on sunless days.

The heat collector unit on the roof faces south, and has a 57-deg horizontal slope, and a surface area of 400 sq ft for receiving the sun's heat. Additional solar energy will reach the collector by reflection from the roof, which is covered with aluminum. In addition, a large window on the south side of the house, opening into the living room, will collect additional heat during sunlight hours. The heat-storing equipment is designed to keep the house at a constant 68-deg temperature, but supplementary electric heating units have been provided for long periods of extremely cold weather without sun.

The solar energy work at MIT is under a steering committee composed of Professors L. B. Anderson, A. G. H. Dietz, Assoc. M. ASCE, A. L. Hesselschwerdt, Jr., and H. C. Hottel, representing the various engineering departments. Research directly associated with the house will be directed by Edmund L. Czapek, research associate in architecture, who directed construction of the house from a design made by J. Frank Haws, a student in the department of architecture.

Reduction in Engineering Enrollment Held Vital

ENROLLMENT IN COLUMBIA University's School of Engineering must be reduced to from 900 to 800 students, if the school is to make its best contribution to engineering education and to American life, James K. Finch, M. ASCE, dean of the school, declared in his recent annual report for the academic year, 1947–1948.

The school, which now has 948 students, reached a postwar peak enrollment of nearly 1,100, according to Dean Finch. In accommodating such a student body, he said, the facilities of the school have been taxed to the utmost, "solely in response to a national emergency and as a public duty."

Warning of the ill effects of "over-enthusiastic popularizers of science who suggest that it is advances in natural science alone which are remaking the world," Dean Finch said that this attitude often leads to neglect of the problems of practical engineering science. "A continuation of this trend cannot but act unfavorably on the future of progress and service of the engineering profession," he declared. "Adequate recognition of and support for research in engineering, in all phases from engineering science to engineering economics, from the material to the human problems of the profession are, as is adequate encouragement and support for natural science, essential to the future progress of civilization."

ESTABLISHMENT OF THE Harvard Foundation for Advanced Study and Research to further the interests of the university's five graduate and professional schools, has been announced by James B. Conant, president of Harvard University. Supported by alumni and other friends of the five schools —Arts and Sciences, Design, Education, Engineering and Public Administration— the Foundation will serve in a fund-raising and disbursement capacity for the schools. Its principal objectives, President Conant said, will be to provide for student housing, research, fellowships, and scholarships in the areas of graduate study encompassed by the schools.

* * * *

THE CIVIL ENGINEERING Department of South Dakota State College—in cooperation with the South Dakota State Highway Department, the Public Roads Administration, and the Association of County Highway Officials—is sponsoring a Highway Short Course to be held in Brookings, April 12 and 13. The course is designed for county highway superintendents, Highway Department and city employees, and contractors engaged in road construction.

NEWS OF Engineers

A. N. Murray, since 1946 hydraulic engineer and chief of the Operations and Maintenance Division of the Bureau of Reclamation at Chico, Calif., has accepted an appointment as regional water rights engineer in Sacramento. Mr. Murray will be responsible for engineering analyses of water rights on streams affected by Bureau operations in the rivers of the Central Valley, the Coastal area north of Ventura, and the Klamath Project, California-Oregon. He served with the Army Engineers for five years during World War II.

William F. Bingham, previously with the Bureau of Reclamation at Cody, Wyo., is now consulting engineer for the Venezuelan government at Caracas.

Van Court Hare, civil engineer in the chief engineer's office of the Tennessee Valley Authority at Knoxville, Tenn., has been appointed a member of a national committee on financing development of the Massachusetts Institute of Technology. The committee will direct a $20,000,000 expansion program for MIT.

George H. Field resigned March 4 as commissioner of the Bureau of Community Facilities, Federal Works Agency, Washington, D.C. He will be succeeded by **Pere F. Seward,** former deputy commissioner for engineering in the Bureau.

W. A. O'Leary, of the New York City Department of Public Works, has been promoted from the position of project engineer to that of chief of the bureau of sewage disposal design in the department.

Kenneth R. Wolfskill is associated with Teichert & Co., in Sacramento, Calif. He was formerly with the engineering firm of Hardesty & Hanover of New York, N.Y.

H. E. Glenn, since 1945 chief of planning of the South Carolina Research, Planning and Development Board, has returned to the engineering department at Clemson College, after a leave of absence to assist in the organization of the Board. **Charles F. Lynn,** civil engineer, succeeds Mr. Glenn.

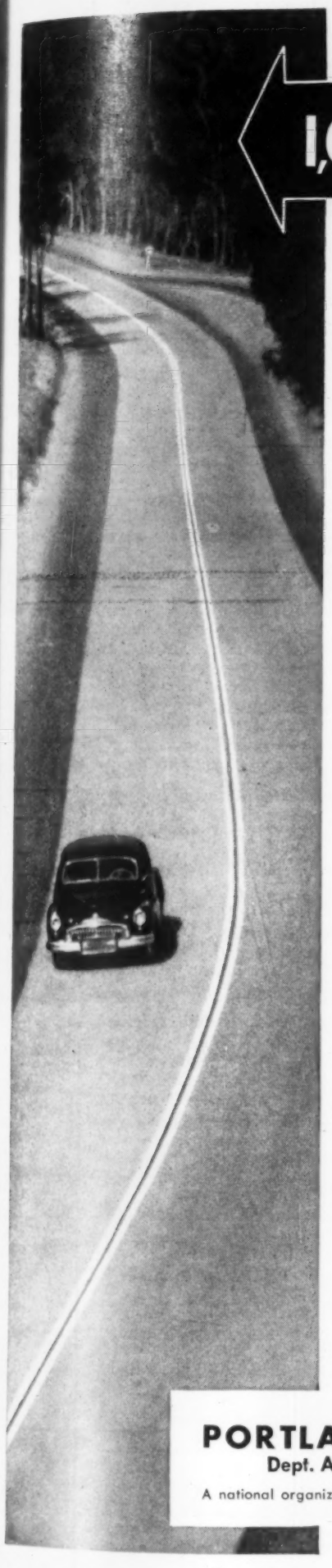
Joseph W. Barker, president of the Research Corp., of New York City, has been elected to the Board of Governors of the Scientific Research Society of America.

Harlan M. Erskine, for the past several years district engineer of the U.S. Geological Survey at Charleston, W.Va., has been transferred to the Bismarck, N.Dak., Water Resources Branch of the Survey.

Charles T. Holmes, previously senior resident engineer for the Texas State Highway Department at Kerrville, Tex., has been named assistant district engineer of District 15 at San Antonio.

Forrest S. Crocker and **Alfred J. Ryan,** in practice as Crocker & Ryan, consulting engineers, of Denver, Colo., announce that Mr.

(*Continued on page 76*)



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Maintenance costs are so often the key to paving programs because as maintenance costs increase, less and less of the paving budget is available for new roads and for improving existing highways. That's why it is so important to build pavements with proved low maintenance costs.

Official records of 28 State Highway Departments, averaging 16 consecutive years and covering maintenance costs on 215,166.2 miles of highways, prove that *concrete costs less to maintain than any other type of pavement.* This is particularly significant because concrete highways usually carry the largest volumes of heavy vehicles.

For more information on how to design ***low-annual-cost*** concrete highways for any traffic conditions write for a free copy of "*Concrete Pavement Design*," distributed only in the United States and Canada.

PORTLAND CEMENT ASSOCIATION

Dept. A4-13, 33 W. Grand Avenue, Chicago 10, Illinois

A national organization to extend and improve the uses of portland cement and concrete through scientific research and engineering field work

(*Continued from page 74*)

Crocker will withdraw from the firm to become a member of the concern of Crocker & Ellett, Inc., engineers and contractors, Denver, and Mr. Ryan will become a successor to the firm of Crocker & Ryan continuing its practice under his own name.

Daniel V. Terrell, ASCE Director and dean of the University of Kentucky College of Engineering, and director of the University's Engineering Experiment Station, was recently honored by the Kentucky Department of Highways and the Louisville Blue Grass Automobile Clubs with certificates of achievement. Dean Terrell was also presented with an honorary 35-year service pin from the Highway Department and a wrist watch from the automobile clubs. On the staff of the University of Kentucky since 1912, he became dean in 1946. In 1914 Dean Terrell prepared a comprehensive state-wide highway plan credited with playing a vital part in the passage of the State Aid Road Law.

D. V. Terrell

Ray Moore is now associated with the Engineering Services Corp., of Los Angeles, Calif., as head of their department dealing with title surveys of business property and of property involved in litigation.

Francis S. Friel, president and treasurer of the Philadelphia firm of Albright & Friel, Inc., has been named to the chair of the Alumni Section of the Drexel Institute of Technology Expansion Program. Mr. Friel recently served as president of the Philadelphia Section.

Philip G. Bruton, who has retired as brigadier general from the Army Corps of Engineers after 30 years of service, and who recently was division engineer of the Pacific Coast Division with headquarters in San Francisco, Calif., has joined the staff of Miller & Ames. In his new undertaking, Mr. Bruton will have charge of the insurance and surety bond service offered to contractors on heavy construction and will be located in the San Francisco office of that firm.

Harry A. Carlson, U.S. Geological Survey engineer, has been transferred from Bryson City, N.C., to the Boston, Mass., office.

Robert L. Miller, for the past 12 years field engineer with the Milwaukee, Wis., district office of the Portland Cement Association, has become connected with Drummond Dolomite, Inc., De Tour, Mich., limestone products company. Mr. Miller will be engaged in the development of new sales markets and product engineering.

Donald T. Davidson, now assistant professor of civil engineering at Iowa State College, where he is engaged in teaching and research work, was recently awarded the doctor of philosophy degree in highway engineering by that institution.

ASCE members elected to office in the American Water Works Association include **W. Victor Weir,** superintendent and chief engineer of the St. Louis County Water Co., and Missouri Water Co., as vice-president, and **William W. Brush,** editor of *Water Works Engineering*, New York City, as treasurer.

Howard F. Fetters announces the establishment of a main office at Ann Arbor, Mich., for the practice of civil engineering, with a branch office at Port Huron, Mich., which will continue under the direction of **Henry Lumsden** as manager.

Urban D. Gosselin, formerly assistant to the president of F. H. McGraw & Co., engineering and construction concern of Hartford, Conn., has been elected vice-president of that firm. Mr. Gosselin will remain in the Hartford office, where he will cover company projects now under way in nearly every part of the country.

Norman Lane, engineer, has been transferred from the Denver, Colo., office of the International Engineering Corp., to the Los Angeles office.

Earle M. Rader, former Dade County (Florida) engineer, has been appointed chairman of the long-term capital improvement committee which is to be an advisory board to the Miami commission. The committee—representing 23 business, professional, and civic organizations, all members of the city planning board—will determine needed city improvements and recommend the manner and order in which each improvement will be financed.

Stuart Allen has accepted the newly created post of assistant town engineer of Milford, Conn., to help solve the highway maintenance and drainage problems of that area. During the recent war, he served with the 293d Combat Engineers in England, Norway, and Germany.

John D. Mendenhall is now supervising structural engineer for the Ralph M. Parsons Co., architect-engineer-manager, on various Atomic Energy Commission projects at Los Alamos, N. Mex. Previously, Mr. Mendenhall was chief structural engineer with the Parsons-Aerojet Co., on the design of the $30,000,000 Naval Air Missile Test Center at Point Mugu, Calif.

Officers of the Knoxville Technical Society for 1949 include ASCE members: **Charles W. Okey,** principal civil engineer, TVA, second vice president; **Samuel D. Cooper,** architect and engineer, Cooper & Perry, secretary; **Addison E. Hook,** cost engineer, TVA, treasurer; and **Don H. Mattern,** senior civil engineer, TVA, director.

Arthur J. McNair, associate professor of civil engineering at the University of Colorado, will join the staff of the Cornell University School of Civil Engineering in a similar capacity next fall.

A. Andrew Boemi has been elected vice-president of the First Federal Savings and Loan Association of Chicago, Ill. Since joining the organization in 1946, Mr. Boemi has been instrumental in the supervision of large-scale housing development. During the war he served as secretary to the Navy Housing Board and as assistant administrative officer for the Navy Department.

Deceased

Ralph Edward Byrne, Jr. (Assoc. M. '46) associate professor of applied mechanics at California Institute of Technology, died in October 1948, according to word just received at Society Headquarters. He was 37. An alumnus of the California Institute of Technology, class of 1933, Professor Byrne obtained his doctorate there in 1940. He had taught at Caltech and at the University of California in Los Angeles, and at one time was structural designer for the Pacific Electric Railway Co. in Los Angeles. Professor Byrne was the author of numerous papers on technical subjects in ASCE and other publications.

Ralph Dominguez (M. '18) of Buenos Aires, Argentine Republic, died on October 5, 1948, according to a recent notification. He was 67. Born in Veracruz, Mexico, Mr. Dominguez was educated at Cornell University. He had been with the Isthmian Canal Commission; resident engineer on railroad construction in Bolivia and the Argentine; and division engineer for the Argentina Commission of Roads and Bridges. For the past 25 years he was engaged in petroleum engineering—with the Anglo-Mexican Petroleum Co. in Rio de Janeiro and Buenos Aires, and later with Shell-Mex Argentina, Ltd., in Buenos Aires.

Alfred Raymond Ebberts (Assoc. M. '48) of Sacramento, Calif., died on January 2, at the age of 52. Mr. Ebberts' experience had included positions as engineer of tests for Allegheny County, Pennsylvania; technical director for Colprovia Roads, Inc.; and consultant to the Pittsburgh Coal Co. From 1938 until his death, he was, respectively, assistant and associate testing engineer for the California State Division of Highways at Sacramento.

Glenn Frederick Finner (Jun. '41) of Knoxville, Tenn., died on February 17. Mr. Finner was 29 and a graduate of the University of Wisconsin, class of 1941. Following his graduation, he was employed by the TVA, the Tennessee Eastman Corp., and the Engineering School of the University of Tennessee. Since June 1948 he had been in the employ of the Wilson-Weesner-Wilkinson Co.

Irving Cheney Hess (Assoc. M. '24) division engineer for the California Water & Telephone Co., San Diego, Calif., died on February 13. His age was 67. Mr. Hess' experience included positions as office and field engineer for the Natomas Co. at Sacramento, Calif., on irrigation, reclamation, and drainage work; as district engineer for the Oroville-Wyandotte Irrigation District at Oroville, Calif.; and as chief engineer for the Pacific Palisades Association at Los Angeles on the development of an 800-acre subdivision. In 1936 Mr. Hess became connected with the California Water & Telephone Co., as assistant engineer, and since 1940 he had been division engineer.

(*Continued on page 78*)

Engineering Facts about

Johns-Manville TRANSITE PRESSURE PIPE

The Inyokern Earthquake

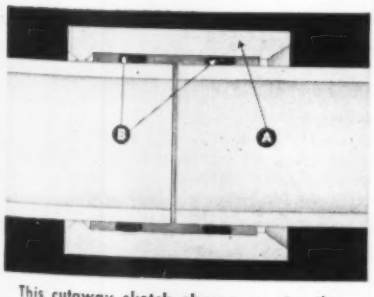
WATER LINES are seldom required to withstand a test as severe as that to which a Transite* asbestos-cement Pipe installation was subjected at Inyokern, California, about two years ago. The Transite installation at Inyokern consists of over 300,000 feet of pipe and comprises the major portion of the water supply system for the vast Naval Ordnance Test Station located there.

During the early part of 1946, an earthquake of maximum intensity occurred in the Inyokern area. Shocks of great severity were felt throughout the immediate locality in which the Transite line was laid. Naturally, concern was felt at the Naval establishment for the safety of its water supply.

After the quake had subsided, crews were dispatched to repair whatever damage the lines might have suffered. A thorough search failed to reveal a single break or any evidence of leakage at any one of the 25,000 joints in the system. Subsequent careful check of pressures and measurement of water levels confirmed that the lines had remained intact.

This aerial view shows a portion of the Naval Ordnance Test Station at Inyokern, California.

The reason this Transite installation was able to withstand this severe test is found in the inherent strength of the pipe and in the design of its Simplex Coupling, the standard coupling for Transite Pressure Pipe. Each of these couplings is a tight yet flexible link connecting one section of pipe to another and imparting to the line as a whole a degree of flexibility which enables it to "roll with the punch." Thus, shocks and vibrations are absorbed, stresses minimized to an unusual degree.



This cutaway sketch shows construction of the Simplex Coupling used with Transite Pressure Pipe. It consists of Transite sleeve "A" and two rubber rings "B" which are tightly compressed between sleeve and pipe as the coupling is assembled.

A factory-made joint which requires only assembly on the job, the Simplex Coupling derives its flexibility from its simple design. Consisting of a Transite sleeve and two rubber rings tightly compressed between pipe and sleeve, its simplicity and ease of assembly are apparent from the accompanying illustration. Moreover, this coupling is readily checked for proper assembly as the line is laid—further assurance of tightness in each individual joint and in the line as a whole.

Probably your water lines will never be called upon to absorb punishment as severe as the Transite lines at Inyokern. But the same engineering advances which protected this Transite installation can be depended on to safeguard equally well against the stresses normally encountered in water line service.

For further information about Transite Pressure Pipe, write Johns-Manville, Box 290, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

*Transite is a registered Johns-Manville Trade Mark

(Continued from page 76)

James Lincoln Fyfe (M. '04) of Oak Ridge, Ill., died on January 21, at the age of 80. Beginning in 1900, Mr. Fyfe was for a number of years in charge of the Chicago consulting office of E. C. and R. M. Shankland. Structures designed under his supervision during this period included the Chicago terminal building for the Lake Shore & Michigan Southern and the Chicago, Rock Island & Pacific Railway companies; a large office building for the Chicago & Northwestern Railway; and a royal palace in Tokyo. Later Mr. Fyfe had his own engineering and architectural practice in Chicago and Oak Park.

Lewis Repp Ferguson (M. '19) former vice-president of the Lone Star Cement Corp., Dallas, Tex., died suddenly at his home there on February 23, at the age of 68. Mr. Ferguson was with the Lone Star Co. from 1926 until his retirement three years ago, and he was serving it in an advisory capacity at the time of his death. He had also been chief engineer and assistant secretary of the Portland Cement Association, and in World War I was general manager of the Liberty Shipbuilding Co. An authority in the field of concrete, he was active in the development of concrete ships and held numerous patents on concrete machines. Prominent in the activities of the Texas Section, Mr. Ferguson served as president in 1939 and on the Board of Directors in 1940 and 1941. He had also been chairman of the Section's Committee on Student Chapters.

L. R. Ferguson

Stirling Enoch McCullough (M. '45) vice-president of the Houston, Tex., firm of Brown & Root, died at his home in that city on January 1. He was 49. From 1923 to 1940 Mr. McCullough was with the W. E. Callahan Construction Co., as engineer superintendent on the construction of dams, irrigation systems, and jetties in the United States and Mexico. In the early years of the war he was with the Hawaiian Constructors, in charge of all construction on a U.S. Engineer Department contract in Hawaii, and with Brown-Bellows, in charge of all operations on construction of a $63,000,000 ordnance depot at McAlester, Okla. Since December 1943 he had been with Brown & Root, in general charge of construction projects. During World War I Mr. McCullough served with the 23d Engineers, AEF.

Oren McKenney Moulton (Assoc. M. '12) of Brookline, Mass., died on January 9. Mr. Moulton, who was 68, had been assistant engineer for the Town of Brookline for many years. In his early career he was engaged in municipal engineering work for the cities of Medford, Mass., and Waterbury, Conn. He had also been with the Passaic Valley Sewerage Commissioners at Newark, N.J., and with the Salmon River Land & Development Co., on surveys for hydroelectric development.

Frederick Ross Muhs (M. '08) retired president of the San Francisco Bridge Co., was fatally stricken at the Bohemian Club in that city on February 9. He was 77. Born in Iowa and a graduate of Iowa State College, Mr. Muhs later established a consulting practice in San Francisco. In 1919 he became connected with the San Francisco Bridge Co., which he headed until his retirement a few years ago.

Charles Jasper Pollard (M. '35) valuation engineer of Buffalo, N.Y., died on February 11. Mr. Pollard, who was 58, had been a partner in the Buffalo valuation and surveying firm of Ellsworth, Barrows & Pollard since 1921. At the time of his death he was owner of the firm. Mr. Pollard was an engineering graduate of Harvard University, class of 1918.

Guy Robert Ramsey (Assoc. M. '03) retired engineer of Orlando, Fla., died recently, at the age of 77. For many years prior to his retirement Mr. Ramsey maintained a consulting practice in Orlando—for some time as a partner in the firm of Ramsey-Herndon & Co. During the war he served as examining engineer for the Reconstruction Finance Corp., in Washington. Mr. Ramsey's early experience was in railroad work—with the Erie; the West Virginia Short Line; the Pittsburgh, McKeesport & Connesville Railway Co.; and the Tennessee Coal, Iron & Railroad Co.

Wilford Ashford Thompson (M. '09) retired engineer of East St. Louis, Ill., died in North Little Rock, Ark., on January 29. His age was 70. Mr. Thompson's experience included a number of years as assistant city engineer of East St. Louis and eight years as St. Clair County surveyor. He served in the first World War.

Philip Harrington (M. '40) chairman of the Chicago Transit Authority, died in West Palm Beach, Fla., on February 11, at the age of 63. Mr. Harrington was with the Sanitary District of Chicago in varying capacities from 1910 to 1921 and from 1923 to 1935. In the latter year he became connected with the City of Chicago, which he served as traction engineer, commissioner of subways and traction, and superhighway chief. Since 1945 he had been chairman of the Chicago Transit Authority, in charge of the acquisition, operation, and modernization of local transit in the metropolitan area. While with the Sanitary District, Mr. Harrington directed the design and construction of more than $100,000,000 of tunnels and sewage-disposal works in the Chicago district. He was co-inventor of a system of flash-drying and incineration of sewerage sludge and other materials.

Philip Harrington

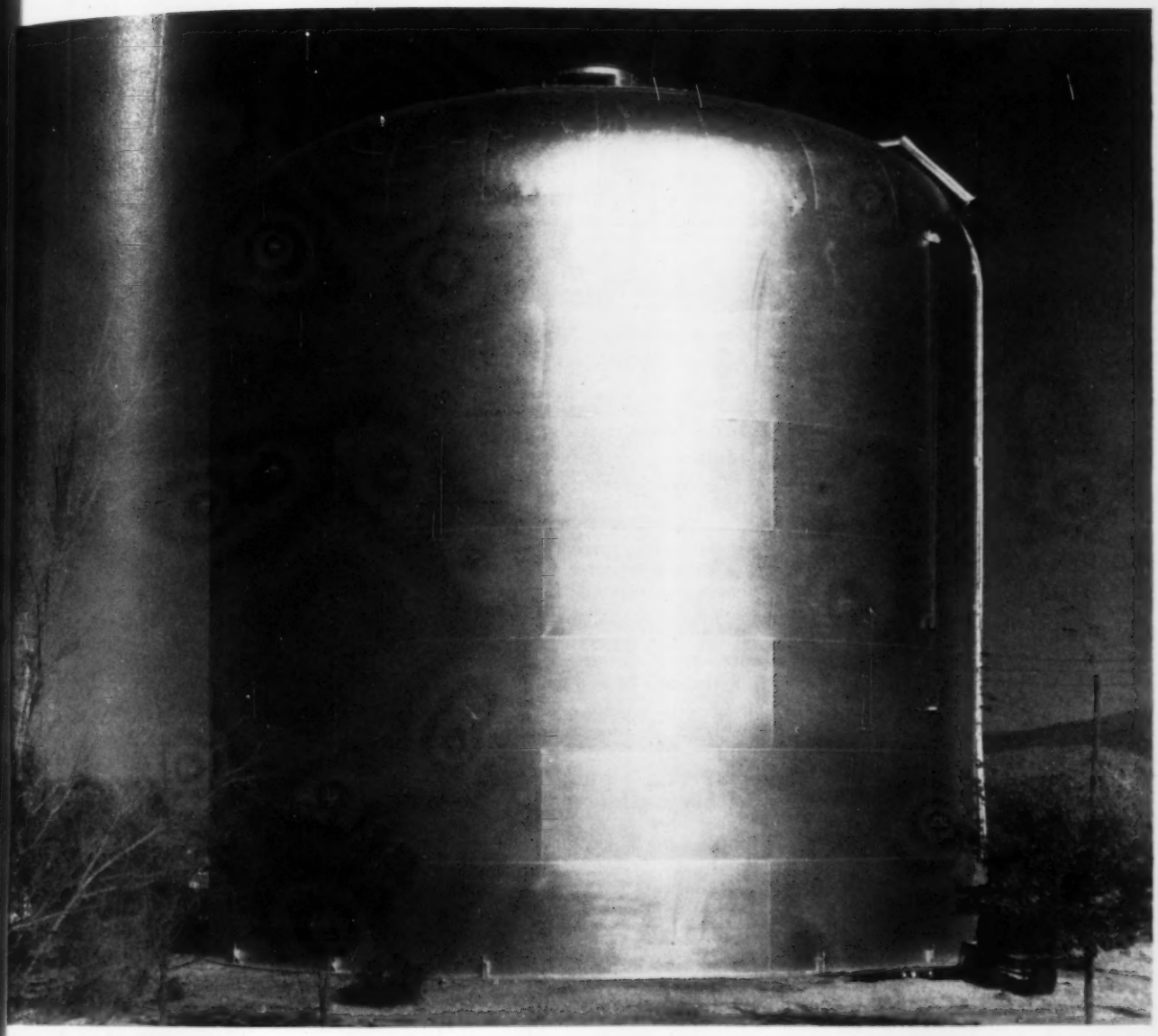
John A. Widder (Affiliate '44) of Rockville Center, N.Y., died on December 3, 1948. Mr. Widder, who was 55, had been construction engineer for the Standard Bitulithic Co., New York City, since 1943. From 1925 to 1943 he was with William Halton, until March 1935 as president and general superintendent of Nassau Amiesite Co., in charge of various road-building projects on Long Island; 1935 to 1941 as sales engineer for the Halton Amiesite Co., Inc.; and after the latter year as general superintendent of the Amiesite Construction Co., in charge of the construction of roads in the metropolitan area and of airport runways at the Schenectady, N.Y., airport.

Sanford Eleazer Thompson (M. '06) who just retired as president of the Thompson & Lichtner Co., Brookline, Mass., died in Phoenix, Ariz., on February 25, at the age of 82. From 1905 to 1917 Mr. Thompson was in private consulting practice, and since the latter year was connected with the Thompson & Lichtner Co., first as senior partner in the firm and after 1925 as president. His firm specialized in management, marketing research, and construction. In World War I, Mr. Thompson served as a lieutenant colonel in the Ordnance Department of the Army, and in World War II he was consultant to the Secretary of War. He was author of papers on management and construction, and co-author of books on concrete and concrete costs. Mr. Thompson was an honorary member and past vice-president of the American Concrete Institute, and a former director of the Boston Society of Civil Engineers.

S. E. Thompson

William Monroe White (M. '24) retired engineer of Milwaukee, Wis., died at his home in Coral Gables, Fla., on February 9. His age was 77. Mr. White retired in 1942 as manager and chief engineer of the hydraulics department of the Allis-Chalmers Co., in Milwaukee, after 31 years in that post. An authority in turbine design, Mr. White designed the turbines for Hoover Dam and many other notable structures. He was a past-president of the Milwaukee Engineering Society, and former chairman of the board of directors of the Hydraulics Corporation of America.

Frank Walden Wright (M. '46) town engineer of Hamden, Conn., died at his home there on February 22, at the age of 64. A graduate of the Sheffield School of Yale University, class of 1906, Mr. Wright gained early experience with the New York, New Haven & Hartford Railroad and with the Winchester Repeating Arms Co. Later he was division engineer for the Connecticut Highway Department, and a member of the firm of Card & Wright in Putnam, Conn. For the past few months he had been on leave of absence from his position as town engineer of Hamden, a post he had held since 1921. Long active in the Connecticut Society of Engineers, Mr. Wright was president of the organization in 1946.



Horton Welded Steel Reservoir at Hot Springs

Horton reservoirs offer an economical method of improving the water pressure in a city's distribution system under certain conditions. When a location on high ground is available, reservoirs give results comparable to those provided by large-capacity elevated tanks—more uniform water pressure in all parts of the distribution system at all times of the day; less work for pumping equipment during peak demand periods; savings in pumping station power costs; and lower fire insurance premiums.

The 1,000,000-gal. Horton reservoir at Hot Springs, New Mexico, is located on a hill near the center of the city. From this location, it is able to serve about three-quarters of the city's area. The clean lines of the reservoir, and its simple maintenance requirements, are a result of the butt-welded steel construction used throughout.

The 1,000,000-gal. Horton reservoir shown above was erected at Hot Springs, New Mexico. A location on high ground was available, and the tank provides gravity water pressure to improve water service in the city's distribution system. Ask our nearest office to tell you about the benefits of storage for your water system.

CHICAGO BRIDGE & IRON COMPANY

Atlanta 3	2167 Healey Bldg.	Detroit 26	1541 Lafayette Bldg.	Philadelphia 3	1652-1700 Walnut St. Bldg.
Birmingham 1	1596 N. Fiftieth St.	Havana	402 Abreu Bldg.	Salt Lake City 1	1509-1st Security Bank Bldg.
Boston 10	1009-201 Devonshire St.	Houston 2	2128 National Standard Bldg.	San Francisco 11	1284-22 Battery St. Bldg.
Chicago 4	2199 McCormick Bldg.	Los Angeles 14	1556 General Petroleum Bldg.	Seattle	1309 Stuart Bldg.
Cleveland 15	2263 Guildhall Bldg.	New York 6	3395-165 Broadway Bldg.	Tulsa 3	1647 Hunt Bldg.

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNA.

Sewage Treatment Research Plants Study Florida Problems

(*Continued from page 38*)

The primary clarifiers are designed for the anticipated 16-hour average flow and with a retention time of two hours. The three clarifiers provide for $^1/_7$, $^2/_7$ and $^4/_7$ of the maximum flow respectively. Any one, or any combination can be used. The clarifiers are rectangular in plan, with a constant depth of 9.5 ft, and provide for an overflow rate of 850 gal per sq ft per day. Each clarifier is equipped with straight-line mechanical sludge and scum-removal equipment.

In the design of the standard-rate trickling filter, 30 percent removal of B.O.D. in the primaries was assumed. A design capacity of 350,000 gal per day, and a loading of 300 lb of B.O.D. per acre-ft per day resulted in a 112-ft-dia filter with 6 ft of media. Birmingham blast-furnace slag was used as being the most economical material with general acceptability. Sewage is loaded through a dosing siphon and a four-arm rotating distributer.

The high-rate trickling filter is likewise designed to treat 350,000 gal per day, with 2,500 lb of B.O.D. per acre-ft per day, which results in a 40-ft diameter with 6 ft of media. A separate pump house provides for recirculation through a two-arm rotary distributor.

Radial sampling channels at the 2-ft and 4-ft levels in each filter give an ideal opportunity to study the two filter systems with identical sewage and should provide data on the comparative economy and effectiveness of the standard and high-rate filters.

Secondary clarifiers are designed for a detention time of $2^1/_2$ hours and an overflow rate of 1,000 gal per sq ft per day. The three tanks provide for $^1/_7$, $^2/_7$, and $^4/_7$ of the capacity of the plant. The flow characteristics may be varied by using any combination of the tanks, thus permitting a study of loading rates and effectiveness of the clarifiers.

The two 30-ft-dia digesters provide 4 cu ft of capacity for each 100 gal of raw sewage per day. The sludge beds, divided into four separate units, provide 1.5 sq ft of surface for each 100 gal of raw sewage per day. The bottoms of the beds are carefully sloped to underdrains laid in coarse material.

The chlorine contact chambers have a 20-min contact time for a flow of 700,000 gal per day and 70 min for 100,000 gal per day. An unusual opportunity to study the disinfection effectiveness of chlorine is available in this unit.

Contract for the construction of the new plant was awarded to the Paul Smith Construction Co. of Tampa, general contractors, on a cost plus fixed fee basis. The major equipment was purchased by the university and installed by the contractor. Work was commenced on October 14, 1946, and the plant has been in use since September 1947.

Good Design and Chemical Treatment Give Long Life to Wood Waterfront Structures

(*Continued from page 26*)

superior material of construction for works to control beach erosion. On beaches where the sand entraining waves have the erosive action of "liquid emery paper," heavily creosoted timber materials are preeminent for the construction of groins, bulkheads and jetties.

About 25 years ago the Pennsylvania Railroad erected creosoted Southern pine pile ferry racks and dolphin clusters at their Exchange Place, Jersey City, passenger terminal. These racks, under the very severe conditions of exposure and wear to which such structures are subjected, are in daily use today. (See photograph.) Pile replacements for maintenance began about five years ago, but it is estimated that about 80 percent of the original piles are still in service after 25 years. The average life of untreated oak rack piles in New York harbor is about 8 years.

In the six years encompassing World War II (1939–1945) it has been said that the equivalent of more than half a century of normal scientific and technological progress was compressed. In the specific field of timber design and research, progress in the last ten years has been equally rapid.

India Taps Enormous Water and Power Resources

(*Continued from page 30*)

general rules can be listed however:

1. Use local materials whenever they can be obtained in sufficient quantities and at a reasonable cost. Employ local labor accustomed to use the local materials.

2. Consider the climatic conditions. In the tropics, provide structures in which people can live and work in reasonable comfort.

3. Make designs simple. Many complications in design justifiable in the United States may become objectionable in Asia and may even make operation unsatisfactory.

4. Consider transportation and weight limitations. Because of their different life and different kind of food, local laborers may be smaller in stature and physically weaker than men doing similar work in the United States. Unless water transportation is available, heavy pieces of equipment often cannot be moved. Even the availability of railroads is not always the answer. Many of the railroads are narrow gage with small carrying capacity and limited clearances, particularly at bridges and tunnels.

Earth Dams Often Preferred to Concrete

When large expenditures are involved, as in the building of dams, the tendency in the United States is to build concrete dams if geological conditions make them feasible and economical. In Asiatic countries definite preference must be given to earth or rock-filled dams. Cement generally is not available for concrete. Even if the estimated cost of a concrete dam is the same, local factors still favor an earth or rockfill structure. Only where considerable height is required or where it is impossible to arrange a spillway of safe capacity should a concrete dam be proposed.

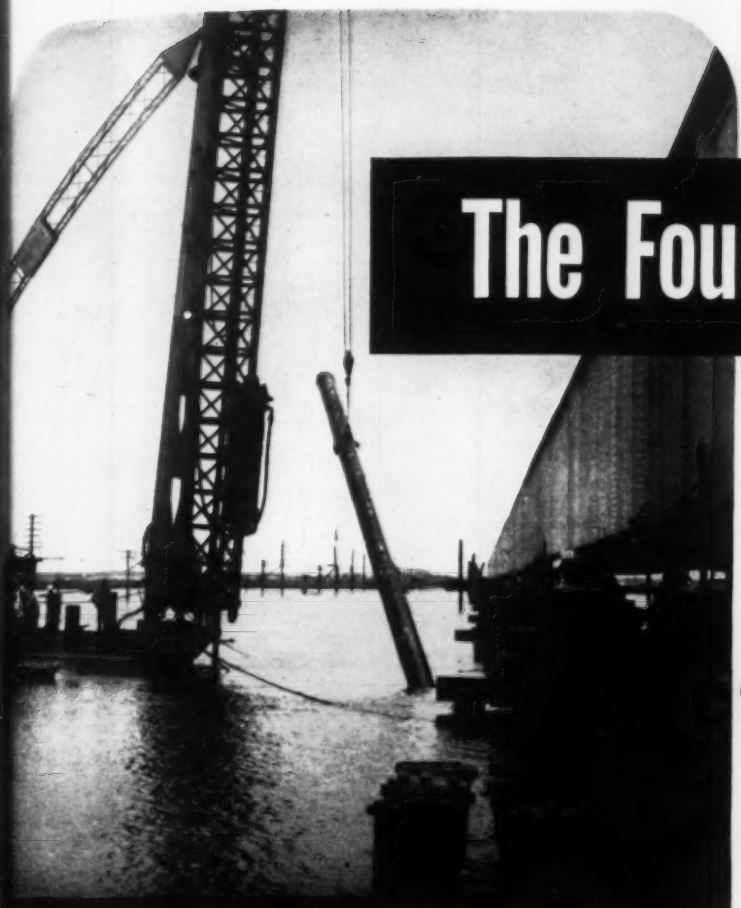
The engineering profession has the important duty of understanding local conditions so that its technical advice can be applied wisely in expending the immense sums now being spent and to be made available in the future for the development of Asia.

New Publications

Highway Safety. Research to date on the problem of highway glare, conducted by the Road Research Laboratory of the British Department of Scientific and Industrial Research, has been issued as Road Research Technical Paper No. 14, *Interim Measures for the Prevention of Dazzle on Roads*. Copies, priced at 6d locally and 7d for foreign purchase, may be obtained from His Majesty's Stationery Office, London.

Port Development. Publication of a 1947 revised report on the Ports of Philadelphia, Pa., and Camden and Gloucester, N.J., is announced by the U.S. Maritime Commission. Issued as No. 7 of the Port Series, the report sells for $2 a copy, upon application to the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

(*Continued on page 82*)



The Foundation Pipe

with the "BIG 6"

ARMCO Foundation Pipe was used in the sixteen piers supporting this railway bridge across the West Pascagoula River. Individual piers have two groups of eight piles each. A floating pile driver drove the 80-foot lengths, which were made up of two 40-foot sections welded together, at the bridge site. After driving, the piles were filled with reinforced concrete.

When heavy construction projects go on your drafting boards you'll want to look into these six time- and money-saving possibilities of ARMCO Welded Steel Foundation Pipe:

1. A wide range of diameters (6 to 36 inches) and wall thicknesses (3/16-to ½-inch) save money and material because you use light or heavy wall, as needed.

2. By ordering any specified lengths that can be handled and shipped, cut-off losses are reduced and field operations speeded.

3. ARMCO Foundation Pipe is exceptionally round and straight. This reduces the number of crooked or rejected piles, and piles with specified load reduction. It also makes inspection easier after driving.

4. Uniform diameter end-to-end means salvageable cut-offs, constant cross section for good end bearing and high bending resistance throughout the length.

5. Steel end-closure plates, cone drive-points, special-cutting shoes or welding collars can be mill-attached to eliminate inconvenience and cost of field welding.

6. The tough spiral weld imparts high collapse resistance and extra lateral stiffness to even the longest lengths. ARMCO Pipe drives straight and requires only a simple driving head and no mandrel.

Keep that next job right on schedule by using strong, easy-to-handle ARMCO Foundation Pipe. Ask for a quotation on your specific needs. Armco Drainage & Metal Products, Inc., Welded Pipe Sales Division, 1995 Curtis Street, Middletown, Ohio. Export: The Armco International Corporation.

ARMCO FOUNDATION PIPE

ARMCO

(*Continued from page 80*)

Sedimentation Problems. Papers and discussions presented at the Federal Inter-Agency Sedimentation Conference, held at the Bureau of Reclamation Laboratories in Denver in May 1947, have been published by the Bureau of Reclamation in a 314-page Proceedings. Agencies cooperating in the conference, in addition to the Bureau of Reclamation, were the U.S. Soil Conservation Service, Forest Service, Coast and Geodetic Survey, Geological Survey, Office of Land Utilization, and Bureau of Indian Affairs; the Army Corps of Engineers; the Federal Power Commission; and the Tennessee Valley Authority. Copies are available for limited distribution at the Washington offices of each of the cooperating agencies.

Atomic Energy. Latest developments in atomic energy in the United States and 23 other nations will be covered in a new biweekly *Atomic Energy Newsletter*, which will advise on current atomic tracer techniques in the various industries and professions. Capacities of atomic power plants will be shown, costs analyzed, and comparisons made with present power means. Inquiries should be addressed to *Atomic Energy Newsletter*, 509 Fifth Avenue, New York 17, N.Y. Subscriptions at the rate of $18 a year include a special information service.

Airports. Proceedings of the Third Short Course and Conference on Airport Management and Planning—held at the Texas A. & M. College in June 1948, under sponsorship of the School of Engineering, Southern Flight, and the Civil Aeronautics Administration—are now available as Bulletin No. 109 of the Engineering Experiment Station. For copies of the bulletin or other information, address the Texas Engineering Experiment Station, A. and M. College System, College Station, Tex.

Hydrology. Stream-flow conditions in the United States and Canada for the period 1921–1945 are pictured by G. E. Harbeck, Jr., and Walter B. Langbein, Assoc. M. ASCE, in a 35-page report, *Normals and Variations in Runoff*, 1921–1945. Issued by the U.S. Geological Survey as Water Resources Review Supplement No. 2, the publication may be obtained without charge from either the Chief Hydraulic Engineer, U.S.G.S., Washington, D.C., or the Acting Controller, Dominion Water and Power Bureau, Ottawa, Canada.

Professional Examinations. Solutions to Part II (Basic Engineering Sciences) New York State P. E. Examinations, February and July 1948, and February and June 1947, have been published by John D. Constance, 625 Hudson Terrace, Cliffside Park, N.J. Copies sell for 50 cents per examination, or $1.50 for all four. Addendum III to *California Civil Engineer Examinations and Their Solution*, by A. E. Waegemann, Jun. ASCE, covers solutions for the May 1948 Examination for Registered Civil Engineer. Copies may be obtained at 50 cents each from the author at 2833 Webster Street, San Francisco, Calif.

Timber Engineering. Basic information on timber design is provided in a 147-page booklet, entitled *Modern Timber Engineering*. Now available for distribution through the Southern Pine Association, New Orleans, La., the book is the third edition of a publication originally released in 1942 under the title, *A Course in Modern Timber Engineering*. Co-authors of the present revision are W. Fleming Scofield and W. H. O'Brien, Associate Members ASCE. The book sells for $1.50 a copy.

Railway Engineering. Latest information on a wide range of railway topics—designed to acquaint the public with one of our basic industries and its place in the life of the nation—is presented in the seventh edition of the Association of American Railroads' *Quiz on Railroads and Railroading*. Copies will be furnished free of charge by the Association of American Railroads, Transportation Building, Washington 6, D.C.

Concrete Bridges. Discussion of continuous T-girder and slab bridges, which afford an economical method for the construction of long spans (up to 150 ft and 35 ft, respectively) is presented in the second edition of *Continuous Concrete Bridges*, issued by the Portland Cement Association. Free copies of the 106-page bulletin are available in the United States and Canada upon request to any Portland Cement Association office.

Virginia Highways. Postwar progress made by the State of Virginia in its 20-year program for road improvement is recorded in the 41st report of the State Highway Commission for the fiscal year ending June 30, 1948. The 84-page brochure is graphically illustrated with photographs of primary and secondary road projects completed during the year. Highlights of the Commission's 1948 improvement program were listed in the February issue (page 70). Inquiries about the report should be addressed to the Commonwealth of Virginia, Division of Purchase and Printing, Richmond, Va.

Bridge Tests. Papers on wind tunnel tests of suspension bridge models comprise a recent bulletin of the Virginia Polytechnic Institute, Engineering Experiment Station Series No. 69. The authors are staff members F. J. Maher, Jun. ASCE, and D. Frederick; E. R. Estes, former graduate student of applied mechanics; and D. B. Steinman, M. ASCE, whose two contributions are reprinted from the October and December 1947 issues of CIVIL ENGINEERING. The bulletin may be purchased from the Engineering Experiment Station at VPI, Blacksburg, Va., at $1 a copy.

Construction. Fifty years of service in the construction field are celebrated in the December 1948 issue of *Bechtel Briefs*, publication of the Bechtel Corp., of San Francisco. The issue draws attention to construction highlights in the past half century of dramatic change "in the ways and means of construction—from pick and shovel to power and machines."

Ground Water. Circular 33 of the U[S] Geological Survey, entitled *Geology an[d] Water-Bearing Properties of the "1,400-f[t] Sand in the Memphis Area*, by Robe[rt] Schneider and E. M. Cushing, Juniors AS[CE], CE, describes the growing importance [of] the "1,400-ft" sand as a potential source [of] water. The report contains a map showi[ng] the location of wells tapping the "1,400-f[t]" sand in the Memphis area, a structure co[n]tour map of its upper surface, and geologi[c] cross sections based on well logs. It al[so] includes the results of pumping tests ma[de] in connection with the preparation of th[e] report, and of mathematical analyses of th[e] relation of pumpage to fluctuations of wat[er] levels in observation wells. Copies of th[e] report are available on application to th[e] Director of the Geological Survey, Washing[ton] 25, D.C.

Housing. What the veteran should know when he buys his home is concisely set forth in a 24-page booklet of the Housing and Home Finance Agency, titled *For the Home-Buying Veteran*. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D.C., at 5 cents each, or $3.75 per hundred.

Highway Research. Synopses of the papers and reports given at the 28th annual meeting of the Highway Research Board, held in Washington, D.C., in December 1948, are published in the December 194[8] issue of *Highway Research Abstracts*. Requests for copies, priced at 30 cents, should be addressed to the Board at 2101 Constitution Avenue, N.W., Washington 25, D.C. The annual subscription is $3.

Surveying and Mapping. Proceedings of the First Surveying and Mapping Conference—conducted at the University of Florida in October 1948 to arouse interest in more adequate mapping of the state and to coordinate existing mapping information—have been made available as Bulletin No. 24 of the Florida Engineering and Industrial Experiment Station. Copies of the bulletin may be purchased for $1 each from the Director of the Experiment Station, University of Florida, Gainesville, Fla.

ASTM Standards. Recent standards of the American Society for Testing Materials include specifications for three types of portland cement for use where air entrainment is desired (Specifications C-175), and tentative specifications covering bituminous road materials (Specifications D-995, 9[96], 978, and 544). These may be purchased from the ASTM headquarters, 1916 Race Street, Philadelphia 3, Pa., for 25 cents each.

Water Resources. Ground-water levels in Ohio for 1947 are summarized in Bulletin 16 of the Ohio Water Resources Board by Donald W. Van Tuyl, Jun. ASCE, and Paul Kaser. Prepared in cooperation with the U.S. Geological Survey, the bulletin reports recent findings in Ohio's long-term survey of its underground water resources. Inquiries should be addressed to the Ohio Water Resources Board at Columbus, Ohio.

(*Continued on page 85*)

Part of R. A. Heintz's "Caterpillar" Zoned Equipment fleet, building highway near Moscow, Idaho. In the background a D8 *pulls a "Caterpillar" No.* 80 *Scraper on a medium-length haul. The scraper in the foreground is being push-loaded by a* D8. *In a moment the "Caterpillar" Diesel* DW10 *Tractor will roll off with it to a distant fill.*

Zone the job

. . . and move more earth faster

"CATERPILLAR" Zoned Equipment is being used by more and more contractors to speed up jobs and increase profits.

R. A. Heintz, of Portland, Oregon, has been doing it for four years. His highway contract near Moscow, Idaho, is a good example of efficient job-zoning.

"Caterpillar" Diesel D8 Tractors, with No. 8S Bulldozers, do the pioneering and push-loading; "Caterpillar" No. 80 Scrapers, drawn by D8 Tractors, handle the medium hauls; and fast "Caterpillar" DW10 Tractors, rolling on rubber tires, pull scrapers over the longer distances.

Besides the definite advantages of using the right tools for each zone, with every piece of equipment designed to do its particular job best, Heintz benefits in other ways:

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2 One manufacturer is responsible for the whole line-up.

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R. A. HEINTZ *likes the "Caterpillar" Diesel* DW10 *for speed on long hauls. He bought his first* DW10s *in* 1945 *and has since added several new ones to his fleet. He says "They're plenty fast, with easy steering, and can be operated by any good truck driver. A* DW10 *is dependable, too. It operates when other equipment is down for repairs."*

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Men Available

HIGHLY QUALIFIED TOWN PLANNER AND CIVIL ENGINEER; Assoc. M. ASCE; 43; Chartered Engineer (England). Diploma in town planning; extensive experience in England, South Africa, India, and Australia for 23 years. With Australian government at present; wishes to settle in the U.S.A. Willing to take low salary until ability has been proved. C-473.

JUNIOR ENGINEER; Jun. ASCE; 26; married; B.S. in civil engineering from Virginia Polytechnic Institute. Registered in Virginia. Experienced in general field and office engineering. Desires employment with engineering concern in South or Southwest. C-474.

ENGINEER; Jun. ASCE; 36; married; one child; municipal planning experience; Seabee construction and barge operations during war; desires some outside time in construction or maintenance, buildings design, or operation in South. Reports, estimates, and subdivision experience. C-475.

ENGINEER; M. ASCE; 48; married; no children. Experience includes 3 years as structural designer; 5 years as chief engineer in hydraulics, electricity, sewerage systems a.s.f.; 2 years as chief of mechanical department (3 workshops, cars, trucks, and construction equipment); considerable teaching experience; trade and export business experience; foreign languages; technical writer. Location immaterial; prefers West or South. C-476.

ANNOUNCING CIVIL SERVICE EXAMINATION for SUPERINTENDENT CITY WATER WORKS CEDAR RAPIDS, IOWA

Qualifications: Age 30 to 50 years. Engineering degree and ten years experience or B. S. degree and 12 years experience.

Starting salary: $6,000 to $7,500.

Write Civil Service Commission, City Hall, Cedar Rapids, Iowa, for applications and information. Deadline, May 20, 1949.

This placement service is available to members of the Four Founder Societies. If placed as a result of these listings, the applicant agrees to pay a fee at rates listed by the service. These rates—established to maintain an efficient non-profit personnel service—are available upon request. The same rule for payment of fees applies to registrants who advertise in these columns. All replies should be addressed to the key numbers indicated and mailed to the New York Office. Please enclose six cents in postage to cover cost of mailing and return of application. A weekly bulletin of engineering positions open is available to members of the cooperating societies at a subscription rate of $3.50 per quarter or $12 per annum, payable in advance.

STRUCTURAL OR PROJECT ENGINEER; 47; graduate civil engineer experienced in assuming full responsibility for the structural design and construction of industrial buildings and important heavy engineering structures; 25 years' experience in New York metropolitan area. Supervised design and construction; coordinator; client and job authority relations; cost minded. C-477.

CIVIL ENGINEER; Jun. ASCE; 28; married; M.S. in civil engineering; registered in Missouri; nearly 3 years in industry doing structural design and drafting; 2 years and one summer school term teaching structures; foundations, concrete design, and surveying. Desires position with a good future in industry doing structural design or as a teacher. Prefer Northeast location. Available in August. C-478.

Positions Available

CONSTRUCTION ENGINEERS, field and administrative for steam powerhouse construction. Write stating education, experience, marital status, and salary desired. Salaries open. Location, western Pennsylvania. Y-2102.

INSTRUCTOR OR ASSISTANT PROFESSOR, 27–35, preferably with master's degree and practical experience, to teach fluid mechanics, hydraulics, sanitary engineering, strength of materials, and mechanics. Position starts September 1949. Salary open. Location, Pennsylvania. Y-2135.

MUNICIPAL ENGINEER, 35–45, civil graduate, with New York State license and at least 10 years' town or municipal experience, to take charge of streets, buildings, sewage, water, and other facilities. Salary, $5,000–$6,000 a year. Location, Long Island, N.Y. Y-2148.

SALES ENGINEER with some consulting background, to contact present and prospective customers of company engaged in map making through the use of aerial photography. Must have general knowledge of customer's requirements and be able to work up photogrammetric surveys to meet them. Must be willing to travel. Salary about $4,000 a year plus expenses and commission. Location, Washington, D.C. Y-2152.

CONSTRUCTION ESTIMATOR (Req. 1043), 27–40, graduate, with 5 years' experience, to make field investigations for scope determination and prepare preliminary design from word descriptions or test sketches relative to preparation of a variety of cost estimates as follows: physical capital budgets, appropriation requests, comparative estimates for determining economical design, construction procedure equipment, etc. Salary, $6,000–$7,260 a year. Location, Netherlands West Indies. Y-2158.

CONSTRUCTION ENGINEER, over 30, civil graduate, with construction experience as resident engineer or similar capacity on engineering work, preferably bridge or grade separation work. Design experience desirable. Will supervise construction work in the field, either as resident engineer or as engineer in charge of several projects. Work will cover bridge and grade-separation construction, and will also include track work, industrial buildings, and other general engineering jobs. Duties will require layout work, scheduling inspection of construction, preparation of estimates, and related duties. Salary, $4,800–$5,400 a year. Location, Louisiana. Y-2164.

RESEARCH ENGINEER, civil, experienced in applied mechanics, i.e., with some experience in the field of elasticity, plasticity, and materials, particularly steel. Should have knowledge of mathematics and be capable of taking responsibility for the technical aspects of a Navy research project. Salary, $7,200–$9,600 a year. Location, Pennsylvania. Y-2176.

RESEARCH ANALYST, 35–55, with master's degree in engineering or equivalent, with 2 years' experience in soil mechanics field covering investigations pertaining to soil properties and stresses. Additional experience in any field in which the work required a thorough knowledge of the theory of elasticity. Experience in the structural field also desirable. Knowledge of mechanical vibrations also desirable. Duties will include the application of theoretical and empirical knowledge of various engineering subjects to practical problems of an unusual and difficult nature, such as those involving mechanical vibrations, soil mechanics, and indeterminate structures. Salary, $6,500–$7,000 a year. Location, New York, N.Y. Y-2177.

ENGINEERS. (*a*) Computer-Draftsman, preferably civil graduate, with topographical, highway, and irrigation experience for construction project in Afghanistan. Two-year contract. Salary, $5,400 a year, plus expenses. (*b*) Construction Engineer, civil, preferably with some background in irrigation, highway, or large earthmoving projects. Two-year contract with 2 months' bonus pay. Salary, $6,000 a year, plus all cost of living expenses. Must accept 6 months' single status. Location, Afghanistan. Y-2178.

PROFESSOR OR ASSOCIATE PROFESSOR in civil engineering, to do research, and build and arrange a new laboratory for highway problem investigations in Turkey. Salary open. Position starts October 1949. Y-2183.

CONSTRUCTION SUPERINTENDENT with at least 10 years' chemical or process construction experience, to supervise layout and erection of refinery equipment. Salary, $8,000 a year. Duration, 2 years. Location, Venezuela. Y-2201.

HYDROELECTRIC ENGINEER, civil graduate, with experience in field survey for large hydroelectric development in Venezuela. Duration, 9 months to a year. Salary, $15,000–$18,000 a year. Y-2202.

ESTIMATOR for building contractor. Must have had at least 5 to 10 years' experience in public works construction. Duties will include quantity take-off, pricing with the assistance of the information given by employer, good erecting jobs, and taking care of details. Salary, $5,200–$6,500 a year. Permanent. Location, South. Y-2207.

ASSISTANT PROFESSOR OR PROFESSOR, master's degree and/or experience in structures, teaching experience in both steel and reinforced concrete structures; to teach all undergraduate structural courses and a few basic civil engineering courses, such as elementary surveying, applied mechanics, and strength of materials. Salary, $4,500–$6,000 a year, depending on qualifications. Location, Ohio. Y-2211-D.

ASSISTANT ENGINEER, civil engineering graduate, with training in surveying fundamentals and methods and 2 years' practical experience in surveying. Experience in precise surveying and leveling is desirable. Will act as chief of party. Must own car. Salary, $3,000–$3,600, plus car expenses. Should be resident of New Jersey. Y-2222.

(Continued from page 82)

Welded Bridges. A review of welded bridges constructed in the United States, Canada, and various foreign countries during the past twelve years, by LaMotte Grover, M. ASCE, has been made available in reprint form by the Air Reduction Sales Co. Copies of the 16-page article, which originally appeared in *The Welding Journal*, may be obtained without charge from the Air Reduction Sales Co., 60 East 42nd Street, New York 17, N.Y.

Public Works. Records of all projects constituting New York City's Postwar Works Program since its inception in May 1942 and of those in the 1950–1954 capital program are summarized in the city's current Progress Report, submitted jointly by the Office of the City Construction Coordinator and the City Planning Commission. As of January 1, 1949, date of the report, $1,108,000,000 of plans had been completed, and $1,800,000,000 of plans were under way. Of the completed plans, $148,000,000 of construction had been completed, and $500,000,000 of construction was in progress. Inquiries concerning the report should be addressed to either the City Construction Coordinator or the City Planning Commission.

Stress Analysis. A 92-page mimeographed engineering text, entitled *The Transverse Method for Analysing Continuous Structures*, by Ralph W. Stewart, M. ASCE, features the geometrical properties of elastic curves. Copies, priced at $5, may be obtained by mail from the author at 1200 Arapahoe Street, Los Angeles 6, Calif.

Snow Removal. Costs, equipment, organization, and other snow-removal problems in big cities are treated in Special Report No. 6, *Snow and Ice Control in Cities Over 200,000 Population*, by the Committee on Street Cleaning and Snow Removal of the American Public Works Association. One copy will be sent free to APWA members upon request to the American Public Works Association, 1313 East 60th Street, Chicago 37, Ill.; to others the price is $1 per copy.

Structural Analysis. A reprint of an article, "Calculating Deflection of Curved Beams," by Kenneth E. Lofgren, originally published in *Machine Design* for November 1948, constitutes Bulletin 31 in the Cooper Union Engineering and Science Series. Requests for copies should be addressed to the Librarian, the Cooper Union Library, Cooper Square, New York 3, N.Y.

New Jersey Highways. Major activities of the New Jersey State Highway Department for the fiscal year 1947–1948 are outlined in a recent Department report for the period. Contracts in the amount of $31,-264,000 were awarded for the construction of roads and bridges and the acquisition of rights of way on the state highway system during the period. New developments in building roadways across unstable meadow areas by the use of the so-called sand-drain or sand-well method are cited in the report as the year's "outstanding accomplishment." A more detailed report may be consulted in the New Jersey State Library or in the offices of the State Highway Department in Trenton.

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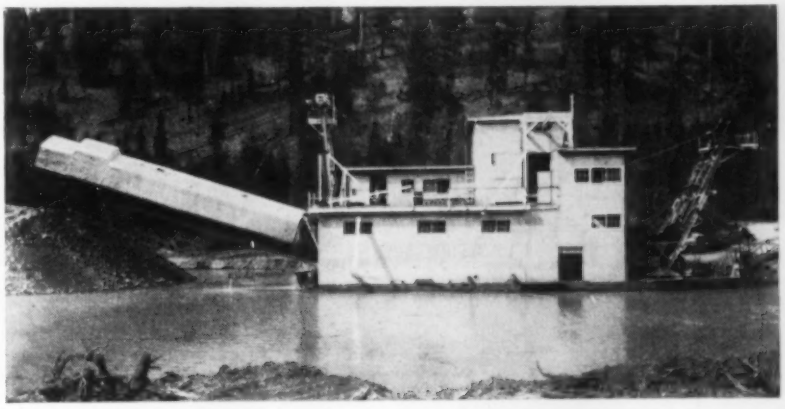

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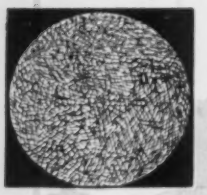

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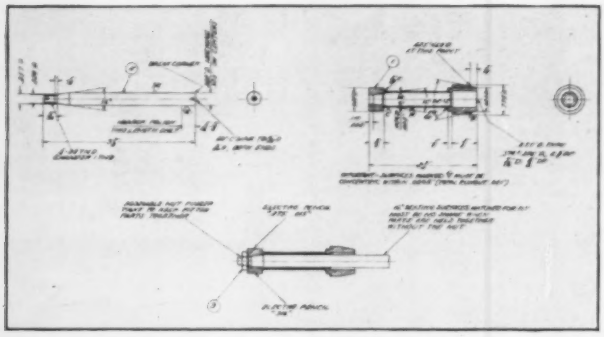

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Recent BOOKS

BIBLIOGRAPHIC SURVEY OF CORROSION 1945, a COMPILATION OF CORROSION ABSTRACTS. By R. D. Misch, J. T. Waber, and H. J. McDonald. Corrosion Research Laboratory, Illinois Institute of Technology, Chicago, Ill. Published by National Association of Corrosion Engineers, 905 Southern Standard Bldg., Houston, Tex. 1948. 129 pp., 11¼ × 8¼ in., cloth, $5. The abstracts included in this survey are divided into two main classes, general material and patents, with each classified into nine main groups. Types of attack; investigations in corrosion; effects of specific media; effects in specific equipment; resistance of materials; methods of prevention; coatings; removal of corrosion products; general and miscellaneous, including books. References included have been taken from the 1945 issues of the six principal indexing services covering the field. A detailed subject index and an author index are included.

CHAMBERS'S TECHNICAL DICTIONARY, rev. ed. with supplement. Edited by C. F. Tweney and L. E. C. Hughes. Macmillan Co., New York, 1948. 976 pp., diagrs., tables, 8¼ × 5½ in., cloth, $6.50. This dictionary defines terms used in pure and applied science, in engineering and construction, in manufacturing and the skilled trades. Additions to this edition include such items as the atom bomb, recently named elements, and newly coined technical words. For the more than 40,000 terms listed a careful identification is made of the field to which the definition applies.

ELEMENTARY STRUCTURAL PROBLEMS IN STEEL AND TIMBER, 3 ed. By C. R. Young and C. F. Morrison. John Wiley & Sons, New York; Chapman & Hall, Ltd., London, 1949. 329 pp., diagrs., charts, tables, 9¼×6 in., cloth, $4.50. The problems presented are solved in detail and involve the design of beams, girders, trusses, and other structures. Part II has been extensively revised in this third edition to give a complete coverage of modern timber engineering. Recent developments in ring construction and design of a glued-laminated wood arch are considered.

ENGINEERING METALS AND THEIR ALLOYS. By C. H. Samans. Macmillan Co., New York, 1949. 913 pp., illus., diagrs., charts, tables, 9½×6 in., cloth, $7.50. This text gives a comprehensive background of metallurgy which should fill the needs of any user of metallic materials. It can be used as a college text for courses dealing with production, physical, or engineering metallurgy. Metals are dealt with in groups according to applications. Their production from ores, heat treatment, shaping and forming are considered, as well as means of corrosion protection. Tables, diagrams, photomicrographs, and references are included.

ENGINEERING THE NEW AGE. By John J. O'Neill. Ives Washburn, Inc., New York, 1949. 320 pp., 8½×5¾ in., cloth, $3.50. What man can do with the enormously expanded facilities at his command to make the world a better place to live in is the substance of this book. Chapters range from a summary of ancient engineers and their accomplishments to consideration of such modern developments as skyscraper construction, city planning, and the traffic problem. In his review of technical developments the author stresses the rapid changes that have taken place since 1800, when "all engineering was civil engineering," to the present, which "begins the era of atomic engineering."

MALARIA CONTROL ON IMPOUNDED WATER. By Federal Security Agency, United States Public Health Service and the Tennessee Valley Authority's Health and Safety Department. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., 1949. 422 pp., illus., diagrs., charts, tables, 9¼×6

(Continued on page 90)

Broadening of Curricula in Engineering Education

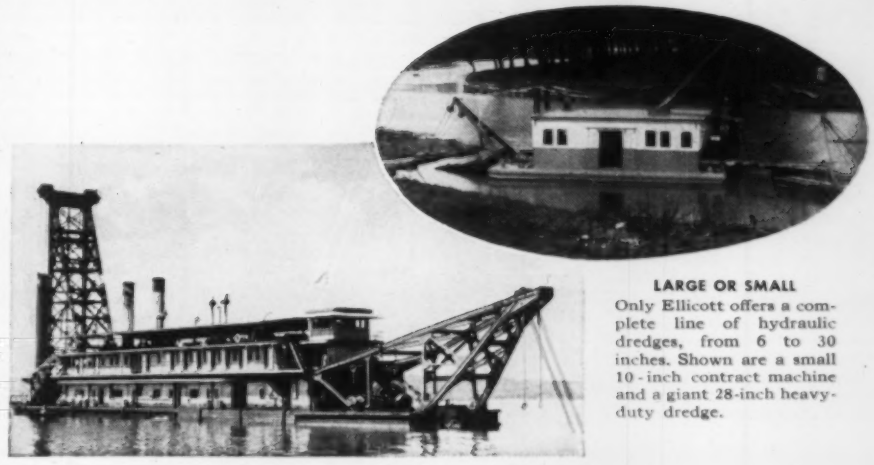
(*Continued from page 35*)

teacher, for instance, considers it a penalty to be assigned to an engineering section. Or a second-rate instructor whose only interest is in obtaining an advanced degree is given supervision of professional students in their non-technical courses.

University of Washington Plan

At the University of Washington an attempt is being made to meet this challenge by having a separate humanistic-social department within the College of Engineering. The department, organized in 1948, is guided by an advisory committee composed of representatives from the engineering school and from various fields in the College of Arts and Sciences. The staff members in the department are responsible, however, to the College of Engineering and are assured that they have a definite career within that college.

In establishing this program, we have not lost sight, for one minute, of the fact that science and technology must be dominant in engineering education. The constant nourishment of scientific and technical achievement is the only means of preserving the American heritage. This can be done in engineering education while at the same time stimulating intellectual and moral interests which will prevail in the years following graduation.



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Alaska Can Harness Its Enormous Waterpower Potential

(*Continued from page 41*)

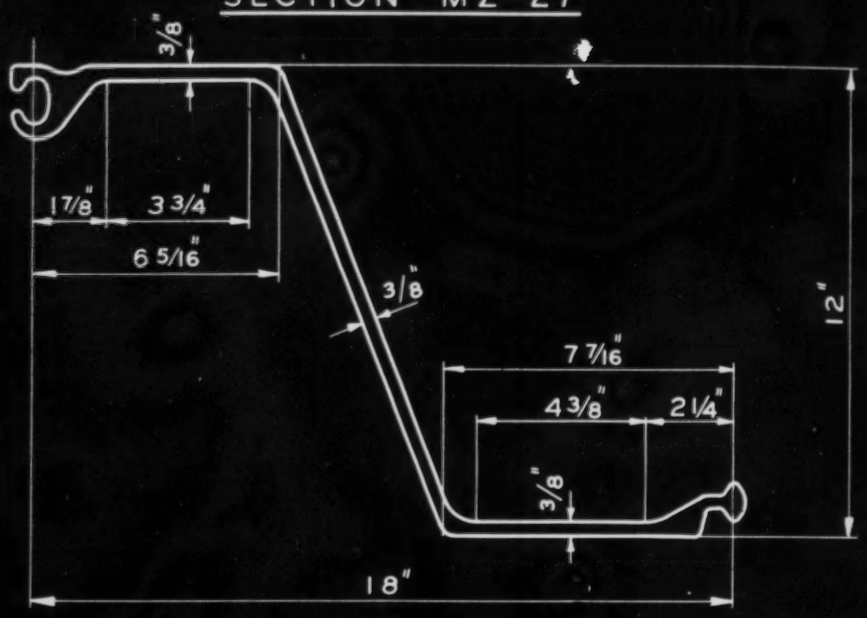
ent a special problem, it would not be insuperable. One very interesting study would be dam height versus spillway requirement inasmuch as every 10 ft of freeboard on the dam could provide emergency storage equal to the average runoff for a period of one year even if no water were released through the powerplant during the period.

Detailed Studies Required

At the upper end of the basin, only a few miles from the Pacific Ocean, the glaciers astride the Coast Range that separate Alaska and British Columbia mark the beginning of the Yukon. The melt from these glaciers cascades into a group of parallel glaciated valleys to form several of the most beautiful lakes in Canada. These interconnected lakes have a surface area of about 500 sq miles. The general elevation of the lakes is 2,100 ft above sea level and their drainage area is 5,000 sq miles. Downstream a low dam in Miles Canyon would raise the water level in the lakes sufficiently for regulatory and holdover storage. Water thus retained could be diverted through a 15-mile tunnel to the Pacific Slope. The average annual power generation would exceed three billion kwhr and could be accomplished without any adverse effect on existing river navigation. An international agreement between the United States and Canada would be a prerequisite to project development.

Development of Alaska's hydroelectric power potentialities is only one use for multiple-purpose river control systems. Ultimately each major drainage basin in the Territory should receive careful consideration for coordinated and comprehensive development of water resources for such benefits as irrigation, flood control, navigation, power production and municipal and industrial supplies. Many years will be required for reconnaissance, study and detailed investigations. The challenge of Alaska requires a response that is consonant with its full possibilities and the nation's needs.

SECTION MZ-27



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SECTION MODULUS PER PILE	45.3 $"^3$
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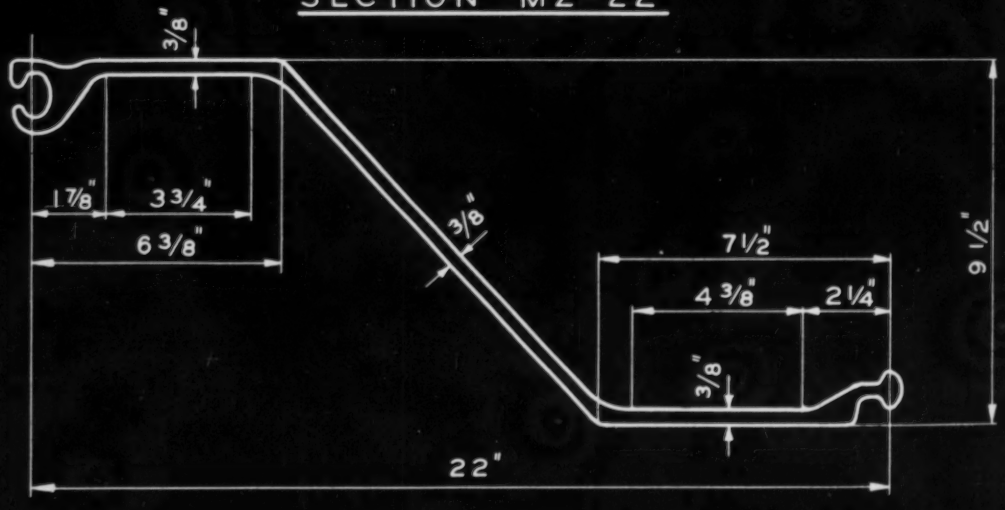
SECTION MZ-22



WEIGHT PER FOOT	40.3 POUNDS
WEIGHT PER SQ.FT. OF WALL	22.0 POUNDS
MOMENT OF INERTIA PER PILE	167.4 $"^4$
SECTION MODULUS PER PILE	34.8 $"^3$
SECTION MODULUS PER FT. OF WALL	19.0 $"^3$

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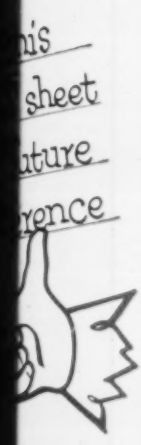
Because you will have many occasions to use these new sections, we suggest that you tear out and file the accompanying data sheet for future reference. Consult our nearest office for information.



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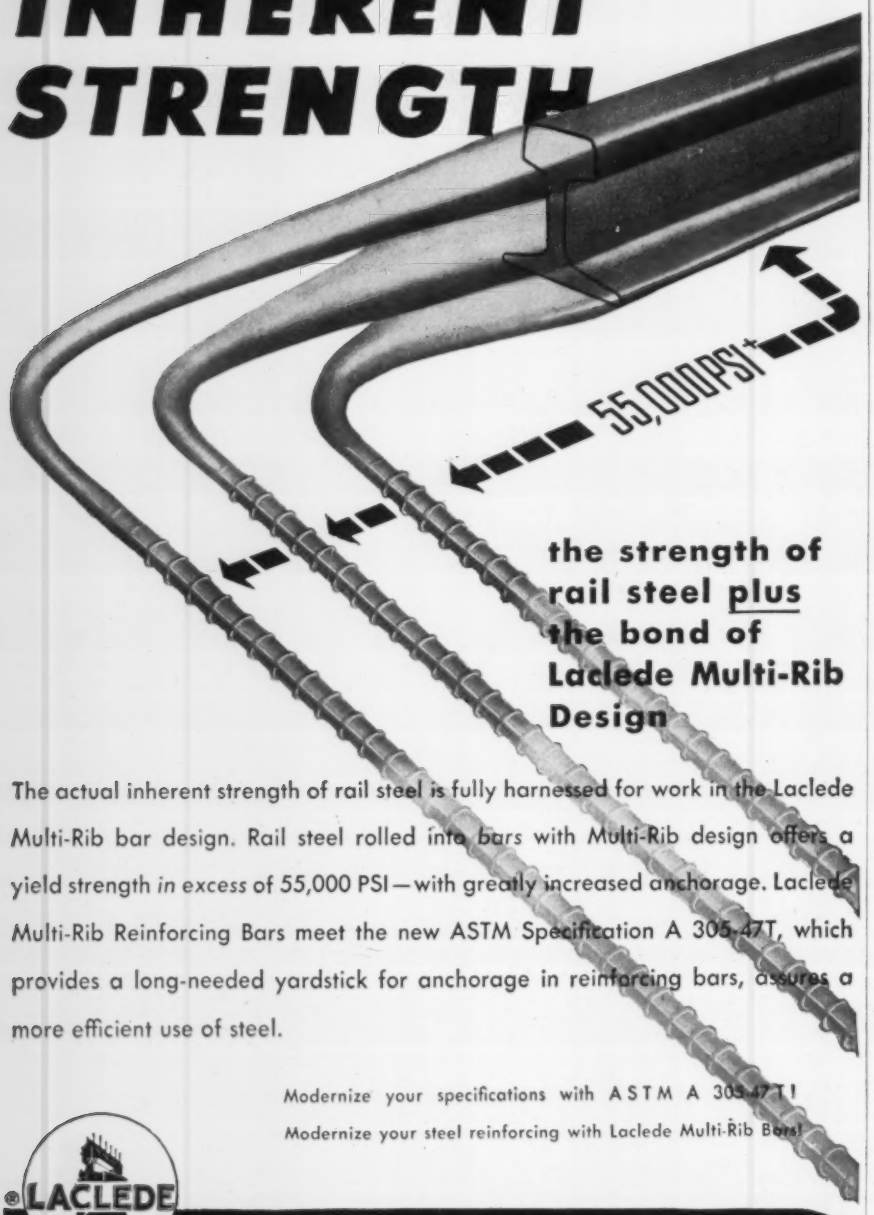

the strength of rail steel plus the bond of Laclede Multi-Rib Design

The actual inherent strength of rail steel is fully harnessed for work in the Laclede Multi-Rib bar design. Rail steel rolled into bars with Multi-Rib design offers a yield strength *in excess* of 55,000 PSI—with greatly increased anchorage. Laclede Multi-Rib Reinforcing Bars meet the new ASTM Specification A 305-47T, which provides a long-needed yardstick for anchorage in reinforcing bars, assures a more efficient use of steel.

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CITY AND STATE .....

(*Continued from page 86*)

in., cloth $2. This manual is arranged as a ready reference text for engineers, medical officers, and others concerned with malaria control. In considering the various phases of malaria control, such as epidemiological engineering, and biological aspects, emphasis has been placed on their practical application to the problem as a whole. Although many of the basic principles and practices discussed are applicable to impounded waters everywhere, special attention has been given to discussion of control measures in the Southeastern States.

CONSTRUCTION IN REINFORCED CONCRETE, 2 ed. By G. P. Manning. Sir Isaac Pitman & Sons, London, W.C. 2, 1947. 182 pp., illus., diagrs., charts, tables $7\frac{1}{2}\times5$ in., cloth, 15*s*. Intended for the use of students and designers, this book gives an elementary knowledge of the practical processes of construction in reinforced concrete. All phases of the preparation of concrete are discussed as well as detailed working instructions.

PLANNING THE MODERN CITY, 2 Vols. By Harold M. Lewis, M. ASCE. John Wiley & Sons, New York; Chapman & Hall, Ltd., London, 1949. Illus., charts, maps, tables, $10\frac{1}{2}\times7\frac{3}{4}$ in., cloth, Vol. 1, 284 pp.; Vol. 2, 224 pp., $6 each. Based on *The Planning of the Modern City* by Nelson P. Lewis, this book is designed for all concerned with the over-all pattern, growth, and development of their community. Following a presentation of introductory material, the author discusses transportation, port development, and highway and street planning. Planning patterns for land use are then considered. Community planning and replanning are treated, and the rise of special planning problems is thoroughly investigated. The final part is devoted to legal, economic, and administrative problems. Selected references and questions follow each chapter.

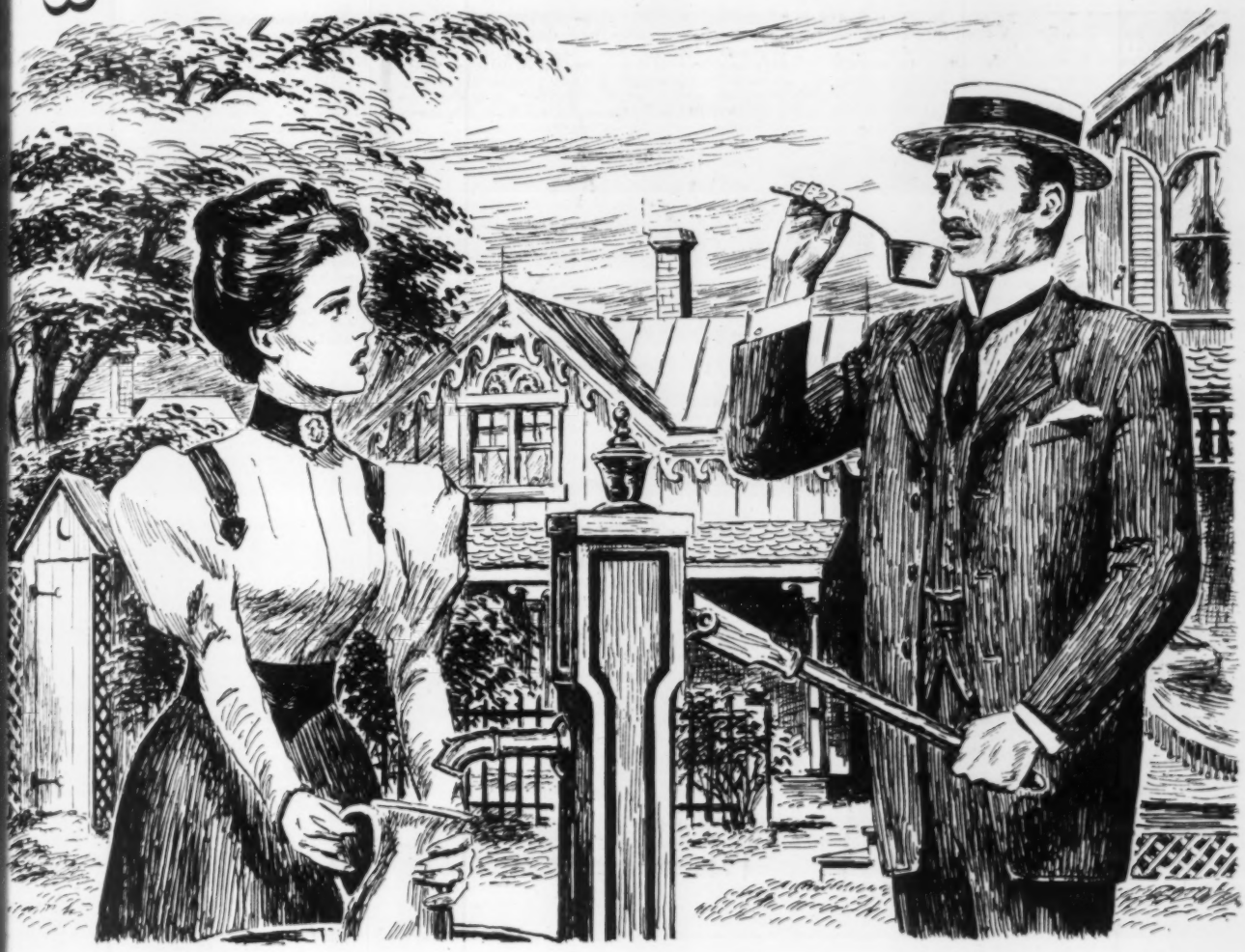
(The) ROYAL SOCIETY EMPIRE SCIENTIFIC CONFERENCE, June–July 1946, Report, 2 Vols. (The) Royal Society, Burlington House, London, W.1, England, 1948. Vol. 1, 828 pp.; Vol. 2, 707 pp., diagrs., charts, maps, tables $8\frac{1}{2}\times5\frac{1}{2}$ in., cloth, £2 2*s*., two volumes. This two-volume report covers the following topics in their relation to the British Empire: Organization, cooperation, and interchange in scientific research; scientific information services and the collection of scientific records; agricultural science; medical science; nutrition; mapping by air; land utilization and conservation; mineral and other natural resources; and postwar needs of fundamental research. The volumes also include a miscellaneous group of papers on a variety of other topics, and some information on the purpose and organization of the conference.

STATISTICAL ABSTRACT OF THE UNITED STATES, 69th ed. Compiled under supervision of M. H. Hansen. U.S. Dept. of Commerce, Bureau of the Census, Washington 25, D.C., 1948. 1054 pp., tables, maps, charts, $9\frac{1}{4}\times5\frac{3}{4}$ in., cloth, $2.75. This reference volume incorporates the important summary statistics on population, trade, production, finance and numerous other subjects. New features of the 69th issue are additional subject material on population forecasts, consumer income, motor fuel consumption, national forests, current industrial production, and size of establishments in the distribution and service industries. A bibliography of sources of statistical data is included.

THEORY OF MODERN STEEL STRUCTURES. Vol. 2, Statically Indeterminate Structures and Space Frames, 2 ed. By Linton E. Grinter, M. ASCE, The Macmillan Co., New York, Toronto, London, 1949. 312 pp., illus., diagrs., tables, $9\frac{1}{4}\times6$ in., cloth, $5.25. In this second edition of the second volume of the *Theory of Modern Steel Structures*, which has been reorganized and rewritten, every effort has been made to simplify and clarify the study of statically indeterminate structures. Though intended primarily for undergraduate curricula, much of the material presented will serve as a text for postgraduate study as well. Chapters include studies on deflection, classical methods of analyzing indeterminate structures; the Cross method of moment distribution, together with the author's extension of the procedure in several directions; and an analysis of arches and rings.

VECTORIAL MECHANICS. By E. A. Milne. Interscience Publishers, 215 Fourth Ave., New York, 1948. 382 pp., diagrs., $9\frac{3}{4}\times6$ in., cloth, $7.50. This book demonstrates the use of vectorial methods in the establishment of general theorems and in the solution of problems in the field of mechanics. It begins with a discussion of vector algebra containing all the results needed for reading the whole volume. This is followed by a systematic account of line vectors. Part III deals with dynamics and contains a section on kinematics. Rigid dynamics and impulsive motion are also considered.

"Tastes kind of funny lately, Ma?"



DURING the past half-century, sanitary engineering has made great strides in combatting diseases caused by pollution of water sources. The year 1899, when our Company was established, also marked the development of sewage treatment in America. Today, more than 6,000 sewage treatment plants are in operation serving over half of our urban population.

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CATALOG DIGESTS of ENGINEERING and INDUSTRIAL Interest

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Allis-Chalmers Mfg. Co.—A most attract ve 32-page booklet is offered on the AD Motor Grader, which possesses increased clearances to handle more dirt, a new blade, more power, better traction, blade range, better operator performance and a rigid backbone. The booklet contains diagrams, descriptions, specifications, graphs, charts and features of the various attachments which you may need on your job.

2 AERIAL MAPPING

Aero Service Corporation—offers catalogs or literature covering its varied aerial mapping services. These include aerial photography, topographic and planimetric maps from an aerial photographic base, precise aerial mosaics, airborne magnetometer surveys for ore and oil, and both plastic and plaster relief maps. Services discussed are used in highway design, plant engineering, industrial development, community planning, geological explorations and prospecting for oil or minerals.

3 AIR COMPRESSORS

The Jaeger Machine Company—Catalog JC-8 describes new sizes of portable compressors which deliver 15% to 20% more air than conventional standard sizes in order to operate present-day air tools at full pressure and efficiency. New sizes are 75 cfm instead of 60, 125 cfm instead of 105, 185 cfm instead of 160, 250 cfm instead of 210, 365 cfm instead of 315, 600 cfm instead of 500.

4 AIR INLET VALVES

Simplex Valve & Meter Company—An essential booklet is Bulletin 125, for all engineers interested in pipe line construction and use. It describes fully and completely the theory and application of Air Inlet (vacuum breaking) valves and discusses why these should be installed on all thin-walled pipe lines where vacuum conditions might cause pipe collapse.

5 ALLOYED IRON AND STEEL

The International Nickel Company, Inc.—"Notes on Alloyed Iron and Steel" is the title of a new 40-page booklet. It is a collection of selected "case histories" on problems involving materials of construction which were originally published as Questions and Answers in Nickel Steel Topics or Nickel Cast Iron News.

6 APPLIED SCIENCE BOOKS

John Wiley & Sons, Inc.—Catalog describing 1,400 titles in all fields of pure and applied science. Of particular interest to civil engineers are the recently published books: Dietz' "Engineering Laminates," Lewis' "Planning the Modern City," Volumes I and II; Hauf and Pfister's "Design of Steel Buildings," third edition; Searles and Ives' "Field Engineering," twenty-second edition; Young and Morrison's "Elementary Structural Problems in Steel and Timber," third edition.

7 ASPHALT CONSTRUCTION

The Texas Company—Step-by-step descriptions of the various types of asphalt construction and maintenance for streets, highways and airports are offered by two booklets. One of these publications is entitled "Road Building with Texaco asphalt by the Pressure Distributor Method." The other is devoted to "Texaco Asphalt Paving—Plant-mixed Types." Useful tables for the road builder and instructions for unloading asphalt products from railroad tank cars are included in this literature, which is offered to interested persons without charge.

8 AUTOMATIC LINE OILER

Gardner-Denver Company—Information is available on a line oiler that protects against operating rock drills or other air-actuated equipment, without adequate lubrication. Known as the L012 automatic line oiler, this device shuts off the line air automatically when all the oil in the reservoir has been used.

9 AUTOMATIC VALVE CONTROL

Philadelphia Gear Works—A 90-page book containing bulletins 1 to 18, on "Limitorque Automatic Valve Control" illustrates and gives full facts and figures about line of controls for operating valves of all types from 3 to 96 in. in diameter. Descriptions of various types of controls are supplemented with pictures, cross sections, outline dimension drawings. Lubrication, push-button control stations, floor stands and air-operated controls are also discussed.

10 BITUMINOUS PAVER

The Jaeger Machine Co.—Catalog BP-9 describes latest model paver with almost instant width adjustability from 5 ft 8 in. to 12 ft 6 in., automatic grade matching, high-speed oscillating serrated edge screed that may be set at negative tilt for laying open-textured mats, hot air screed heating, and other advanced features.

11 BORINGS

Raymond Concrete Pile Company—A booklet "Borings—Why and How," tells a comprehensive story of Raymond's method of making soil investigations essential to the proper design of every structure.

12 CARBURETED ENGINE UNITS

International Harvester Company—A 12-page catalog covers 4 engines and power units which operate on gas, gasoline, or distillate. These engines are rated from 24 to 55 hp. Design features are shown through sectional views and performance charts reveal brake hp, torque, and fuel consumption at various engine speeds. Specifications, dimension data, and a list of attachments are given.

13 CAST IRON PIPE

Cast Iron Pipe Research Association—A 20-page brochure showing instances of the salvaging and re-use of Cast Iron Pipe in water works systems. Various sizes of pipe and several types of installations are covered in this report.

14 CAST IRON PIPE DATA

U.S. Pipe and Foundry Co.—Standardized Mechanical Joint Cast Iron Pipe & Fittings Catalog contains detailed data on U.S. standardized mechanical joint pipe and fittings, sizes 3 to 48 in. inclusive.

15 CEMENT

Lone Star Cement Corporation—A 40-page illustrated booklet summarizing facts disclosed by condition survey, after two decades in service, of the first highways, buildings, and other structures in this country concreted with high early strength cement. Also contains factual information showing where the use of "Incor" high early strength cement saves time and reduces construction costs.

16 CEMENT GUN

Cement Gun Company, Inc.—Of considerable interest to the engineering profession is a 63-page booklet, designated as bulletin 2400, describing the cement gun and its applications. It covers the principal uses of "Gunite" and is profusely illustrated. In the last few pages of this bulletin are typical specifications for various types of "Gunite"-work.

17 CENTRILINE PROCESS

Centriline Corp.—A 30-page folder entitled "The Centriline Process" sets forth the advantages and the effectiveness of cement-mortar linings for water mains. Pictures, with appropriate explanations, show the Centriline machine and water mains before and after reconditioning. Given also are specifications and methods applicable to typical pipe cleaning and cement-mortar lining contracts; a list of contracts already completed by the Centriline Process, and a section on physical tests of cement-mortar linings.

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CATALOG DIGESTS

18 CHEM-O-FEEDERS

Proportioneers, Inc.—Bulletin describes application of chem-o-feeders for chlorine dioxide, hypochlorite, and chemical feeding to municipal and private water supplies, sewerage treatment, and swimming pools. Exclusive "See-Thru" reagent heads permitting visible inspection of all moving parts in contact with chemical solution, corrosion resistance, and ability to operate under high pressure are some of the advantages discussed.

19 COMBINATION CRANE

Hyster Company—The Hystaway, a combination dragline, clamshell, crane, and hoe front for use with "Caterpillar" track-type tractors, is described in a 4-page newspaper format publication called "Hystaway News." Actual case histories with action photographs of various construction, pipe laying and yarding jobs stress the versatility of the unit and the speed with which it can be mounted and dismounted.

20 CONCRETE GUN

The Prehy Company—A 4-page folder describes the construction, operation, and uses of the concrete gun. It is a portable machine entirely operated by compressed air. Because of the unique construction of the feed wheel and the air supply system which creates this even flow, the loss of material due to rebound will be reduced.

21 CONCRETE HAULER

Maxon Construction Co., Inc.—A pamphlet entitled "Dams, Tunnels, Highways" (L-102) is available. This pamphlet illustrates and briefly describes several jobs on which the Dumperete hauled identical loads of premium quality concrete, accurately mixed at a central point by contractors and ready mix operators.

22 CONCRETE PIPE

Lock Joint Pipe Company—Technical and descriptive data in illustrated pamphlet form describing the design, manufacture and installation of concrete cylinder pipe, prestressed concrete cylinder pipe and subaqueous pipe. Illustrated pamphlets and charts explaining flow and leakage tests, joint designs. Also a booklet tabulating the dimensions and weights of sewer and culvert pipe.

23 CONCRETE PIPE FOR IRRIGATION AND DRAINAGE

American Concrete Pipe Association—An official publication has just been released and is available to engineers. Contains information on design of irrigation pipe lines, construction of irrigation pipelines, methods of irrigating with concrete pipe lines and descriptions of various irrigation projects. This book is priced at 70¢.

N.B. There is a charge for this book. Make checks payable to the American Concrete Pipe Association.

24 CONCRETE PIPE LINES

American Concrete Pipe Association—An official publication is now available to engineers. Contains information on flow of water in pipe lines, constructing pipe lines in open cut, constructing pipe lines in tunnels, jacking reinforced concrete pipe lines, subaqueous concrete pipe lines, concrete pipe sewers, drains, and airport drainage lines. This book is priced at $2.00.

N.B. There is a charge for this book. Make checks payable to the American Concrete Pipe Association.

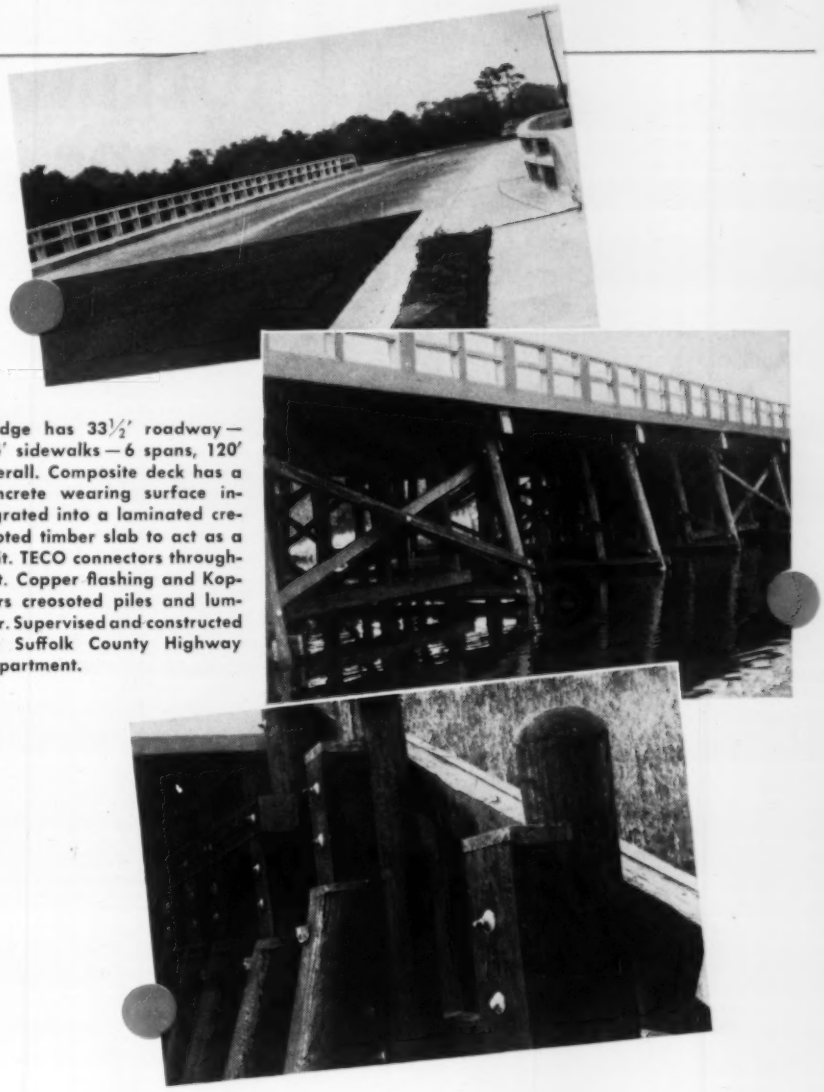
25 CONSTRUCTION DATA

A. C. Horn Co., Inc.—The 1949 edition of the Horn Construction Data and Handbook is free. It comprises 96 pages of charts, diagrams, tables, and construction details, as well as detailed descriptions and uses of Horn materials for building maintenance and construction. This is a standard reference book for maintenance men and engineers.

26 CONTROLLERS AND LAYOUTS

Simplex Valve & Meter Company—Bulletin 250 gives dimensional data on horizontal and vertical type controllers and clearance layouts for these units when using different type close-off arrangements. Type "S" rate controller for use in effluent lines from rapid sand type filters. This bulletin is of essential interest to the filter plant designing engineer.

THE "SUPPORTING" ROLE THAT'S STEALING THE SHOW



Bridge has 33½′ roadway—2-5′ sidewalks—6 spans, 120′ overall. Composite deck has a concrete wearing surface integrated into a laminated creosoted timber slab to act as a unit. TECO connectors throughout. Copper flashing and Koppers creosoted piles and lumber. Supervised and constructed by Suffolk County Highway Department.

● Along with the nation's steadily increasing amount of transportation comes ever-increasing praise for Koppers Pressure-Creosoting.

Its performance on piles, decks, posts, and guard rails has led highway engineers across the nation to report that "Koppers Pressure-Creosoting does the job."

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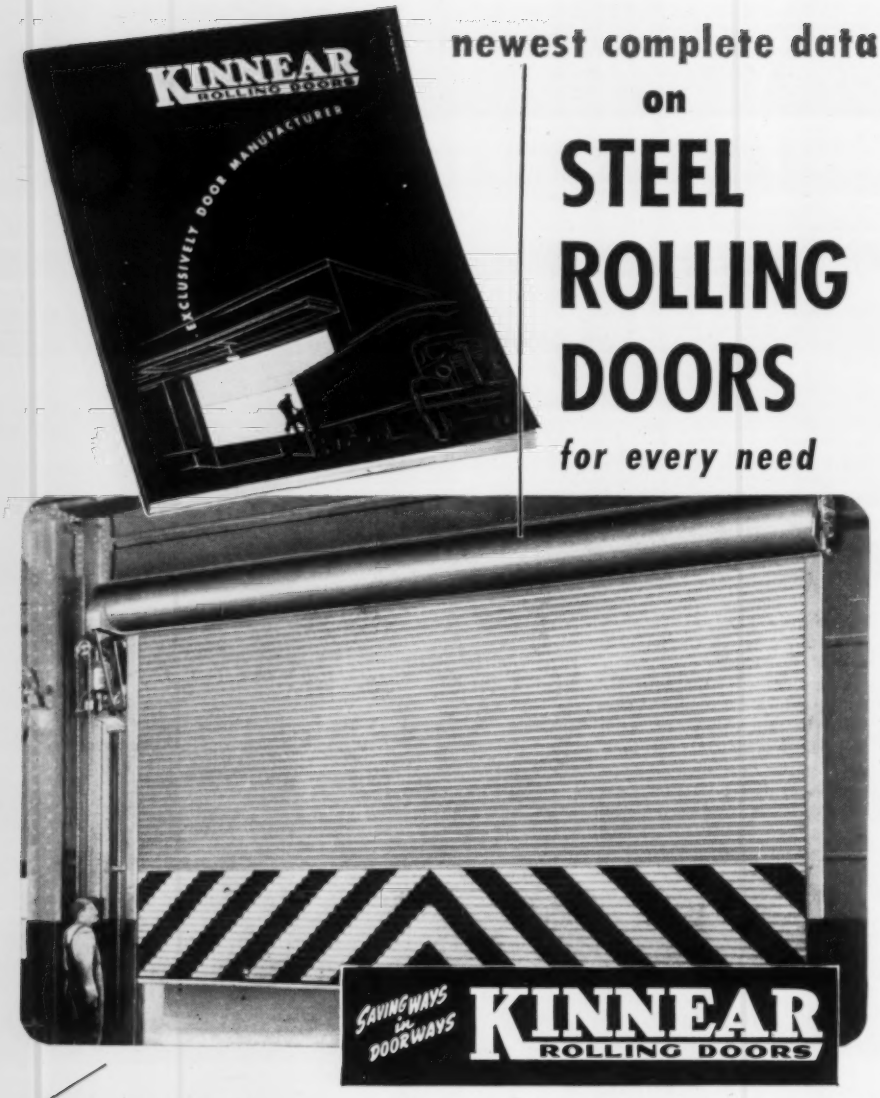

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27 CORR-PLATE STEEL PILING

Caine Steel Company—Catalog gives complete specifications and shows application photo and descriptions of Corr-plate steel piling now being rolled from a new high-strength steel alloy. In a series of bending, compression and tensile strength tests, piling made of the new alloy proved to be 25% stronger than the same piling made of mild steel. Other tests showed the new alloy to have double the corrosion resistance, and thus an indicated life of twice that of mild steel piling.

28 CRAWLER CRANE

Harnischfeger Corporation—Bulletin X11-1 covers a most highly flexible crawler crane known as Model 455A. This machine handles 30,000 lb as a crane, up to and including 1 cu yd bucket as a dragline or clamshell. Some of the other outstanding features of this machine include low-pressure hydraulic control, oversize brake clutches triple-safe boom hoist, synchronized motions, independent crawler brakes, and two-speed transmission.

29 CRAWLER TRACTOR

Allis-Chalmers Mfg. Co.—An attractive 24-page catalog featuring the HD-5 crawler has been released. Photographs and cutaway views illustrate the "5's" track release mechanism, positive sealed truck wheels, and other features which simplify maintenance problems and assure longer life.

30 CRAWLER TRACTORS

International Harvester Company—Separate mailing folders on each of four crawler tractors: the TD-18 Diesel, 80½ drawbar hp; the TD-14 Diesel 57 drawbar hp; the TD-9 Diesel or gasoline, in the 40 drawbar hp range; the TD-6 Diesel or gasoline, in the 30 drawbar hp range. These folders are thoroughly illustrated in 2-color with action scenes. Complete specifications are included.

The coupon is not good after the deadline.

CATALOG DIGESTS

31 CRUSHING AND SCREENING PLANTS

Austin-Western Company—Bulletin No. 1996 describes the latest Austin-Western two-unit and three-unit portable crushing and screening plants which have been developed for either pit or quarry use. How these plants are capable of delivering high tonnages of aggregate in accurately controlled sizes; and how the three units (primary breaker, primary and secondary) may be used separately or in combination, as desired, providing flexibility of operation, is contained in the bulletin.

3. DESIGN FOR ARC WELDED STEEL STRUCTURES

Air Reduction Sales Company—A 300-page definitive work, the first of its kind to be published, was compiled by LaMotte Grover, M. ASCE, a recognized authority in the field of structural welding. The book covers: fundamentals of design materials, inspection, estimating, engineering control of welding and related operations, electrode requirements, specifications for welded connections for all sizes of rolled beams, and a series of diagrams for rapid design of welded connections. The price of this book is $2.00 postpaid.

N.B. There is a charge for this book. Make checks payable to the Air Reduction Sales Company.

33 DESIGN OF CONCRETE MIXES

Portland Cement Association—An attractive 70-page booklet gives detailed information on the design and control of concrete mixes. A few of the well-covered topics are fundamental facts about concrete and other materials. It covers mixing, handling and transporting, curing and protection as well as and special types of concrete. These subjects are illustrated with pictures, charts, and diagrams. The Appendix contains specifications and tests of interest to contractors. This booklet is free, but is distributed only in the United States and Canada.

34 DIAMOND CORE DRILL

Pennsylvania Drilling Co., Inc.—offers a folder illustrating the Penndrill Jeep, a diamond core drill for mounting on a 4-wheel drive Jeep which provides quick, easy transportation on highways, through woods and over rough ground. How the drill, driven by the Jeep motor, with a capacity ranging from 500 ft of NX hole to 1000 ft of EX hole, provides fast drilling and can be readily set aside to free the Jeep for other uses, is also described.

35 DIESEL ENGINES

Caterpillar Tractor Company—A new booklet "Users Know Caterpillar Diesel Engines," Form 12109, spotlights the wide variety of applications to which the manufacturer's line of industrial units, electric sets and marine engines are put. Every field in which the units have been put to work as the power source, has been outlined in the publication with reference to work figures produced in each instance.

36 DIESEL ENGINES AND POWER UNITS

International Harvester Company—A 24-page catalog covers 6 diesel engines ranging from 39 to 180 hp. Design features are shown through many sectional views and performance charts reveal brake hp, torque, and fuel consumption at various engine speeds. Specifications, dimension data, and a list of attachments are also given.

37 DIESEL OIL

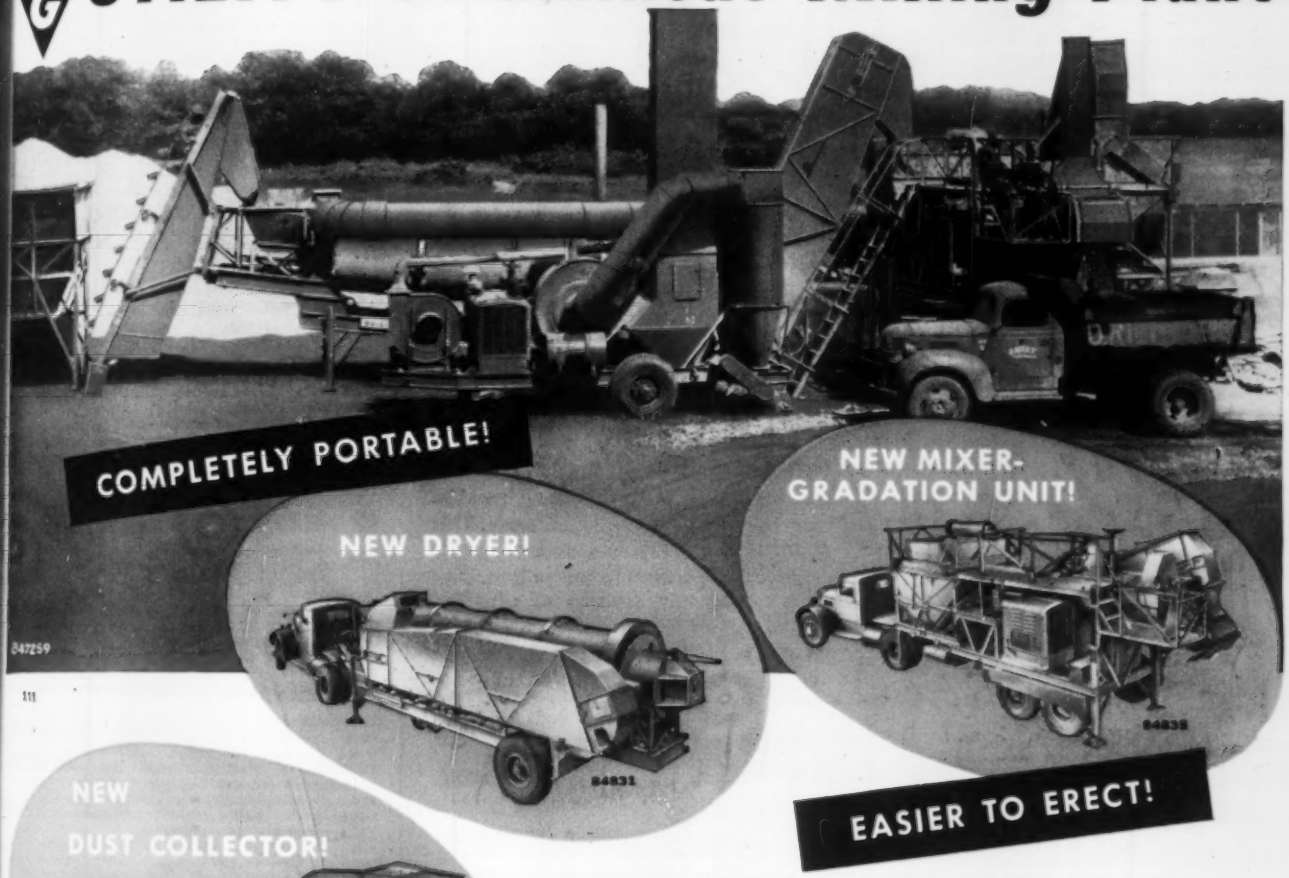
Standard Oil Company (Indiana)—New 12-page booklet, "Nonpareil Diesel Oil . . . Available in Regular and Heavy Duty Types." This booklet gives a brief description of the product and its advantages for Diesel power units in all engineering applications. One of the outstanding features of this booklet is the very helpful listing of jacket water temperatures as recommended by leading diesel engine manufacturers.

38 DOORS, STEEL ROLLING

Kinnear Manufacturing Company—The advantages, the economy, the construction features and the general specifications of the various types of Kinnear wood and steel upward-acting type doors are fully discussed and illustrated in a new catalog and data book just published. Known as Bulletin 50, it gives information on insulation, clearance requirements, methods of operation and controls, as well as the adaptability of the doors for many types of uses.

Barber-Greene

BG UTILITY Bituminous Mixing Plant



This new Barber-Greene Bituminous Mixing Plant was developed to meet specifically the need for a more completely portable, easier-to-erect plant with a capacity in the 60-ton per hour range. Here is a plant that makes the most of manpower — that minimizes the time required for setting up or dismantling — yet retains all the basic B-G advantages of accurate volumetric measurement and proportioning of aggregate and bitumen. The Utility Plant is all this and more, for it can be adapted to produce a constant flow of all types of mixes including the highest types. Each of its basic units incorporates new improvements in design to achieve the maximum in portability, simplicity in erection and operation.

Before bidding on any bituminous job, get full information on this new, advanced design Utility Plant. Use the coupon or see your Barber-Greene distributor for your copy of Bulletin 845.

SOME OF MANY *REVOLUTIONARY FEATURES!*

- *True portability* in every unit
  Faster erection without cranes or heavy equipment
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- *High Discharge Dryer*—eliminates hot elevator pit
- *Two, three* or *four-bin* aggregate gradation

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CATALOG DIGESTS

39 DRAFTING MACHINE

Keuffel & Esser Co.—A booklet explains and illustrates the construction and time-saving operation of the Paragon drafting machine, which combines the function of T-square or straightedge, triangles, protractor, and scales into one unit easily controlled by the left hand alone, leaving the right hand free for drawing.

40 EARTHMOVING EQUIPMENT

Caterpillar Tractor Company—The application of their full range of earth-moving tools is highlighted in a new 16-page color booklet entitled "Profiting Through Earthmoving the Caterpillar Way" or designated as Form 1210S. Work with bulldozers, scrapers, motor graders, wagons and allied tools has been presented in the publication.

41 EFFECTS OF CALCIUM CHLORIDE

Solvay Sales Division, Allied Chemical & Dye Corp.—has prepared a new 39-page booklet, "The Effects of Calcium Chloride on Portland Cement," which is a collection of abstracts from recent research reports giving the effects of calcium chloride on Portland cements under widely varying practices and conditions. Sections are devoted to data and charts regarding acceleration of set, curing, cold weather concreting, workability and density, and other important effects of calcium chloride, as well as material on air-entraining, high-early and other special cements.

Industrial Literature Is Costly. Please request only the booklets of interest to you.

42 ELECTRIC FISH SCREEN

Electric Fish Screen Company—An illustrated single sheet describes the Burkey method of positive fish control, employing specifically engineered electrode systems energized by electronic generators. Designed to prevent fish from entering hydro-electric plants, water systems, and pumping stations as well as to fence fish within lakes and private preserves. The control unit is harmless to marine life.

43 ELECTRODE GUIDE

Air Reduction Sales Company—announce the publication of a new pocket guide to Airco arc welding electrodes. This handy, compact guide presents all the facts pertaining to the most commonly used Airco electrodes along with helpful data regarding the factors to be considered when choosing an electrode for a specific job. The information on each electrode mentioned in the new guide includes description, recommended application and welding procedure. It will prove to be a valuable reference aid to anyone whose work is connected with electric arc welding.

44 ELEVATED WATER STORAGE

Pittsburgh-Des Moines Steel Company—A new catalog, "Modern Water Storage in Elevated Steel Tanks," is now available. This 20-page bulletin includes tables, listing the capacity and the dimensions of various types of standard elevated steel tanks, a discussion of the economics of these various types, a discussion of the advantages derived from elevated water storage, 50 photographs of tank installations and a useful data section.

45 EXCAVATOR

Harnischfeger Corporation—Copy of a new bulletin, X71-2, covering the P&H Model 255A 3/4 yard excavator is now ready for distribution. It embraces 24 pages, is printed in 2-colors, and contains many photographs of the machine equipped as a shovel, dragline, clamshell, crane, trench hoe, and pile driver.

46 EXCAVATOR

Harnischfeger Corporation—For those interested in a 3 to 4 cu yd excavator, it would be well to write and ask for bulletin X-104 covering the P&H Model 1055 excavator. This machine includes such modern features as low-pressure hydraulic control; independent, triple-safe planetary boom hoist; rapid reversing shovel crowd and "Magnetorque" electric swing.

47 FAST CONVERTIBLE SHOVELS

Austin-Western Company—The ability of the "Badger" to do the really tough jobs and to consistently deliver high output is brought forth in a 16-page folder. Illustrations show the "Badger" in cramped quarters and in operation, and each of the several other types of construction tools to which it can be converted. The booklet also covers construction details and charts and tables on working ranges and capacities.

48 FEEDER FOR DRY MATERIALS

Omega Machine Co.—Bulletin 20-23 describes a loss-in-weight type gravimetric feeder which handles almost any granular or powdered material, including lumps to 1¼ in. The feeder weighs, feeds, and records with an accuracy of 99% or better. Bulletin shows operating mechanism and auxiliary equipment, lists materials fed, and gives data for proportional control.

49 FIRE PREVENTATIVES

M & H Valve & Fittings Company—Catalog No. 40 describes and illustrates underwriters' and factory mutual approved fire hydrants, gate valves, indicator posts, swing check valves and underground fittings for automatic sprinkler and private fire protection systems.

50 FIRE-RETARDANT WOOD

Koppers Company, Inc.—offers an attractive and worth-while booklet showing how Koppers fire-retardant treatment on wooden walls, floors, and ceilings can resist flames and still retain their strength and soundness. The development, application and results of this treatment are discussed in detail with diagrams, pictures, and specifications.

CATALOG DIGESTS

51 FLOW METER FOR DRY MATERIALS

Builders-Providence, Inc.—offers Bulletin E4-550 describing the Conveyoflo meter for continuously weighing, totalizing, or proportioning the flow of dry material. The Conveyoflo operates with pneumatic diaphragms and maintains high accuracy over a wide range.

52 FOOTWALKS

Wm. F. Klemp Co.—offers its 1949 edition of their catalog entitled "Klemp Open Steel Grating and Stair Treads, the Perfect Structural Steel Floor-ing," containing information on riveted and welded grating, structural steel footwalks, bridge decking and drain grating, for use in refineries, power houses, sewerage units, mezzanine storage rooms, catwalks, heavy industries, bridges, etc. Fully illustrated, the book includes a safe-load table and complete engineering data.

53 FOUNDATIONS

Drilled-In Caisson Corporation—Literature describes foundation columns anchored in rock sockets; heavy column loads carried on single caissons; penetration through any type of soil to rock at any depth; examination of rock can be made; economy in time and labor; foundation bonded in rock; description, design, specifications, technical data.

54 FOUNDATIONS AND HEAVY CONSTRUCTION

Spencer, White & Prentis, Inc.—Literature on the construction of difficult and unusual foundations; description of concrete-filled steel tubes driven to rock, including technical data, performance and installation; description of Pretest Underpinning and the application of the Pretest Method to construction other than foundations; Pretest foundations; caissons; foundations under existing buildings; shoring and moving buildings.

55 FOUNDATIONS AND SOIL BORINGS

MacArthur Concrete Pile Corp.—A booklet giving concise data on pile foundations describes cast-in-place, composite, steel, sectional pipe, timber and H piles. Also given are notes on soil and rock exploration, and pile, driving problems with special notes and engineering information covering 38 years' experience installing cast-in-place concrete piles.

56 FOUNDATIONS AND UNDERPINNING

Underpinning & Foundation Co., Inc.—Of special interest to engineers is literature describing steel pipe pile foundations and underpinning by pioneers who have specialized in this field; application, design and methods are included. The scope of this Company's work also includes open and pneumatic caissons, subway and tunnel construction, sinking of mine shafts, cofferdams, and all other types of substructures and heavy construction.

57 FRAME CONSTANTS

Portland Cement Association—A handbook of frame constants—especially useful in frame analysis—offers tabulations of fixed end moments, and stiffness and carry-over factors for members with parabolic and straight haunches. This offer is free, but is distributed only in the United States and Canada.

58 GRATING-FLOORING AND TREADS

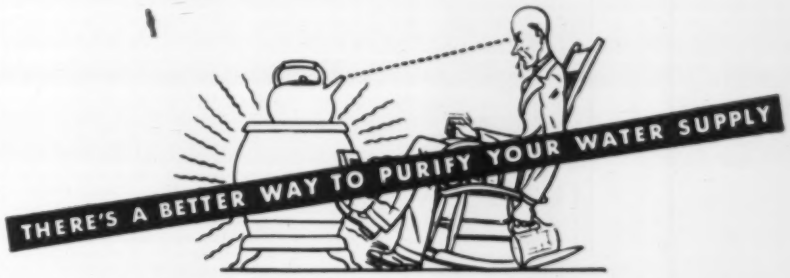
Irving Subway Grating Co., Inc.—Catalog F-225 contains illustrations, descriptions and engineering data on grating-flooring, treads and floor armoring (riveted, press-locked, welded types)—safe, durable, fireproof, ventilating, clean and economical—for industrial, power and refinery walkways, stairways, driveways, trucking aisles; ship cat-walks and engine room floors and treads; locomotive, freight and passenger car runways and treads; roadway armoring, expansion joints, catch basin covers; bridge decking.

59 GROUTING METHODS

The Prehy Company—A 16-page illustrated booklet describes various grouting methods. It contains recommended mixes for each type of job and describes uses of grouting for soil stabilization, solidification of fractured rock, water sealing, drypack concrete, and cast-in-place piles.

60 HAND LEVEL

Keuffel & Esser Co.—A booklet describes the precision-made hand level for speedy and convenient surveying. It also explains and illustrates how one man can use it for rough grading, locating contour lines, etc., and how he, with an assistant and a rod, can take cross section, set slope stakes, etc.



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PROVEN DESIGN. Over 24,000 "%Proportioneers"% units are in use all over the world.

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61 HARDFACING LINE

Air Reduction Sales Company—A 16-page, 2 color, profusely illustrated booklet, which also serves as a hardfacing catalog, describes each of Airco's new alloys in complete detail. Included are data on typical uses, specifications, application technique, deposit hardness, color markings and deposit analysis. Every page is full of helpful, authentic information on how to combat wear and increase equipment work-life.

62 HEAT EXCHANGER

The Dorr Company—"The Spiral Heat Exchanger" is the title of a 4-page booklet, No. 6281, on a new answer to the problem of external sludge heating. Information on what it is, how it works, operating data, advantages, and specifications are fully covered.

63 HIGHWAY BRIDGE SPECIFICATIONS

American Association of State Highway Officials—Recently published is a 284-page cloth-bound book entitled "Standard Specifications for Highway Bridges." Made up in four main divisions with 72 subordinate sections, all details of general provisions, construction, design, and materials are covered. Four Appendices carry tables of moments and shears, steel column formulas and graphs, a chart of truck, train, and equivalent loadings and a diagram of permissible unit stresses for rectangular concrete columns. This book is priced at $3.00.

N. B. There is a charge for this book. Make checks payable to the American Association of State Highway Officials.

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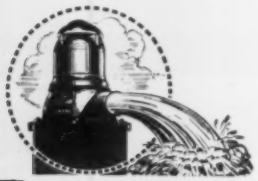

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CATALOG DIGESTS

64 HOIST DRIVE

General Electric Company—This drive is recommended for hoists which handle a wide range of loads, and where accuracy, speed, refined performance, and safety are important. It provides maximum speeds in the raising and lowering of the empty hook, automatically controlled speeds in hoisting or lowering safe overloads, and an inherent stall characteristic which prevents the lifting of excessive overloads. Its advantages on overhead traveling cranes, hammerhead cranes, cargo winches, revolving derricks and other hoists are described in the booklet "Maxspeed Hoist Drive," which also reports on the performance of this drive in speeding concrete placement.

65 HYDRANTS AND GATE VALVES

R. D. Wood Co.—A 22-page booklet, "Mathews Modernized Hydrant," gives detailed description of its various features, with numerous photographs and sectional views to clarify the text. Appropriate space is devoted to the removable barrel, containing all the working parts, to the completely revolving head, and to the Sand-Spun protection case. A portion of this booklet is an illustrated treatment of gate valves that stay reliable under severe service conditions.

66 HYDRAULIC DREDGES

Ellicott Machine Corp.—A 26-page catalog, printed especially for small and medium size dredges and also repair parts, is available to interested parties. In this catalog you will find various types of Ellicott dredges working at all kinds of jobs. The hull, deck house, and machinery items are sectionalized so that they may be easily dismantled, shipped overland to an otherwise inaccessible site, and re-erected with the minimum of trouble.

67 HYDRAULIC LOADER

The Oliver Corporation—The Ware Machine Works loader was designed with the engineering cooperation of the Oliver Corporation and is built exclusively for their tractors. Information, specifications, and pictures of the Ware loader with hydraulically controlled bucket on the Oliver-Cletrac model A is covered in folder A.

68 HYDROPEL

Stancal Asphalt & Bitumuls Co.—An illustrated bulletin describes the product called "Hydropel" and the improvement it makes in portland cement concrete and mortars because of its effectiveness in combating basic difficulties caused by moisture. An explanation of the products, its uses, and the procedures for mixing, curing and testing are included.

69 INFILTRATION COLLECTORS

Ranney Method Water Supplies, Inc.—A seventeen page booklet, entitled "Industrial and Municipal Water," describes the basic principles involved in the design and construction of horizontal infiltration collectors. Included are a list of completed installations and reprints of several technical articles which summarize actual operating experience. Four diagrams and eight construction photographs illustrate the text of the booklet.

70 INSULATION

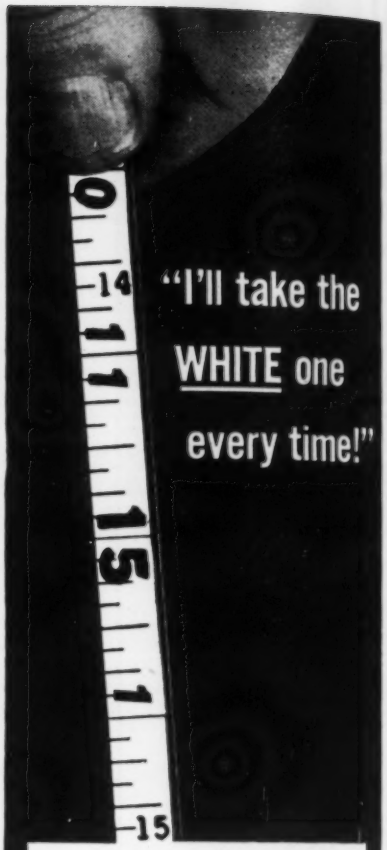
Johns-Manville Corporation—A 4-page folder entitled "Zerolite Insulation," presents the new insulation for low-temperature service. It provides essential data on sizes, temperature limits, conductivity, strength, water absorption, combustibility, etc. Also included are suggested uses for Zerolite, which comes in the form of sheets, lagging, and pipe insulation.

71 LEROY LETTERING BOOKLET

Keuffel & Esser Co.—A Leroy lettering set enables any draftsman to do perfect lettering with speed and ease. Fully illustrated, this booklet (A13) gives complete information on Leroy lettering sets, templates, scribers, pens, and accessories. Several new templates as map welding; electrical symbol; isometric drawing templates; reversed, condensed, and outline Gothic, Cheltenham, and Greek alphabet templates are included.

72 LONG LINE RULING PENS

Keuffel & Esser Co.—offers a booklet which describes and illustrates the new time-saving Marathon long-line ruling pens. These pens have an extra-large ink capacity so they can draw five to eight times more lines between fillings. They are also nonblotting and easily cleaned.



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CATALOG DIGESTS

73 MECHANICAL PIPE JOINTS

R. D. Wood Co.—A 4-page leaflet describing mechanical joints that meet the requirements for permanent tightness of pipe joints under conditions of deflection, expansion, contraction and vibration. They are designed for high-pressure lines for oil, gas, water, steam, or chemicals.

74 MIXING PLANT

Barber-Greene Company—offers Bulletin 845, a 2-color, 8-page lavishly illustrated booklet, on the highly portable, easily erected 845 bituminous mixing plant. A flow chart is included, working and traveling views are shown. Main units of plant are adequately described.

75 NON-CLOG SEWAGE PUMPS

Economy Pumps, Inc.—An illustrated 8-page catalog, No. F.-447, presenting its line of horizontal non-clog sewage pumps is now available. This new bulletin illustrates in cutaway fashion the operation and construction of these sewage pumps. The non-clog construction is primarily adapted to the pumping of liquids containing unscreened sewage, miscellaneous pulps, or trash. Units ranging from 3" to 24" in size are illustrated and described in the catalog. Complete tables of selection and specification are provided.

76 OFF-TRACK EQUIPMENT

Caterpillar Tractor Company—How railroad crews strive to maintain the right-of-way over the nation's massive network of roadbeds is discussed with illustrations in a new booklet entitled "Keeping on Schedule" or designated as Form 11797. The booklet also illustrates maintenance, improvement, realignment and heavy construction and tells how the use of this versatile equipment reduces, or completely eliminates, the need for work trains.

77 OIL STORAGE TANK ROOF

Chicago Bridge and Iron Company—A 4-page leaflet describing the Vapordome roof, which is installed on flat-bottom oil tanks to prevent evaporation losses caused by daily breathing. A flexible membrane in the dome at the center of the roof moves up and down as vapor in the tank expands and contracts due to temperature changes. This prevents daily loss of vapor through the vents. Leaflet contains table of standard Vapordome roof sizes.

78 OPEN STEEL FLOORING

Dravo Corporation—Catalog 1140 describes Tri-Lok open steel flooring, concrete armoring, safety steps, and T-Tri-Lok. The latter is used for modern construction of bridge and building floors, railroad crossing loading platforms, and wherever a self-supporting structure under heavy loads is required.

79 PENCILS

Eagle Pencil Company—Offers an independent report made by the Investigation Committee of Architects and Engineers on the manufacture, testing, and quality of Eagle Turquoise Drawing Pencils and Eagle Verithin Colored Pencils. This report was made after an investigation of all phases of the production and control of these two pencils and presents an independent appraisal of their value to the man behind the drafting board. A free sample in any grade or color will be sent with a request for the report.

80 PENCILS

Eberhard Faber Pencil Company—The Microtomic Van Dyke Drawing Pencil with its exclusive high density lead is claimed to produce more uniformly opaque lines resulting in sharper, cleaner prints. Its greater color density without thickness of lead deposit minimizes the amount of smudging. A sample in any one of 18 specified degrees, along with descriptive literature, will be sent without charge.

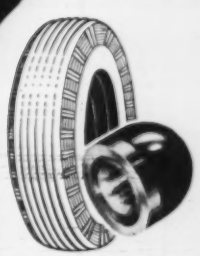
These Catalog Digests cover a wide range of subjects that will interest YOU.

Reduce Form Damage with NEW VIBER RUBBER TIPPED VIBRATORS

Viber Company has long recognized the destructiveness of steel vibrators on many popular form lining materials.

Realizing that damage to Celotex, plaster of Paris inserts for architectural concrete and plywood is expensive, they studied the possibility of using RUBBER TIPPED VIBRATORS.

After critical tests on many large concrete construction jobs, it was found that the new VIBER RUBBER TIPPED VIBRATORS greatly reduced form costs.



Made of high quality live rubber, Viber's Rubber Tipped Vibrators are built to withstand extreme punishment (the same rubber used to make automobile tires)

New style housing with replaceable rubber tips may be used in place of one-piece steel housing. Rubber tips are easily replaced. Simply unscrew worn part and install new tip.

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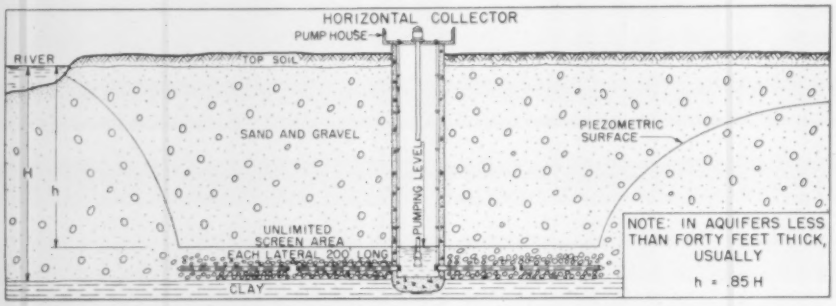

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CATALOG DIGESTS

81 PILES

Raymond Concrete Pile Company—Raymond Standard and Step Tapered Piles are described in literature which also includes information on the scope of Raymond's activities which cover every recognized type of pile foundation including poured concrete, precast concrete, composite wood and concrete, steel, pipe, and wood. Raymond's activities and experience also include the construction of caissons and construction involving shore protection, shipbuilding facilities, and harbor and river developments.

82 PILES AND CAISSONS

Western Foundation Corporation—A new 12-page catalog describes constant diameter piles and caissons which carry the full foundation load to underlying bearing strata. Sketches in 4 colors show how Button Bottom, Pedestal and Caisson Piles are formed and cast in place. Composite piles composed of sections of pipe and thin shell are illustrated as well as the more common wood and concrete composite pile. A tested driven H-core composite is shown for the first time; an H-section is driven through an already driven casing to avoid friction of upper strata and secure high capacity on the core itself which is encased in load-bearing concrete. Special attention is given large-capacity uncased piles to overcome the ever-increasing unit cost and the current shortage of steel.

83 PIPE LINE CONCRETING

Chain Belt Company—"Pumpcrete Practice" is the title of a new manual containing information on pipe line concreting methods. The manual explains in detail the Pumpcrete method of placing high quality unsegregated concrete by pipe line. This volume, regularly priced at $5.00 is offered free of charge to members of the engineering profession and those interested in the pumpcrete method of concrete placement.

84 POCKET TRANSIT

Wm. Ainsworth & Sons, Inc.—A booklet describing and outlining the use of the Brunton pocket transit and accessories is available. The booklet shows how horizontal and vertical angles can be determined to approximately one degree by using an instrument weighing only 8½ ozs. This will be of interest to engineers who have occasion to make rough surveys, check grades and levels, or lay out roads or lines.

85 POLAROID

The Polarizing Instrument Company, Inc.—A 4-page pamphlet illustrating and describing photoelastic polariscope for stress determination and the universal straining frame for photoelastic analysis is offered to the machine designer whose photoelastic stress analysis is not only of value in the verification of calculations based on theoretical solutions, but also in the solution of problems where theoretical analysis is not available.

86 POWER GRADERS

Austin-Western Company—A 28-page Catalog AD-2019 pictures and describes the "99-II" and Master 99 Power Grader with exclusive All-Wheel Drive and All-Wheel Steer. All types of work—rough grading, heavy ditching, scarifying, snow plowing, terracing and drainage, mixing, loading, rolling and bulldozing—are illustrated and discussed. Included also are complete specifications, a description of exclusive design features and detailed illustrations of the attachments.

87 POWER UNITS

Allis-Chalmers Mfg. Co.—A series of booklets in reference to L844, B125, W201, E563 and U318 is offered to the engineer. All booklets are composed of diagrams, specifications, installation dimensions and brief descriptions—all contributing to low operating and maintenance costs.

88 PRECIPITATOR

Permutit Company—In Bulletin 2204 will be found the chief applications for the Permutit Precipitator which are (1) water softening, (2) removal of turbidity, color, taste and odor, (3) removal of alkalinity, (4) removal of silica, and (5) removal of fluorides from water. Operating on the sludge blanket principle the Permutit Precipitator offers: short detention time, lower chemical requirements, absence of settling, uniform sludge filter, adaptability to various rates of flow, and lengthened filter runs. Specifications are also given.

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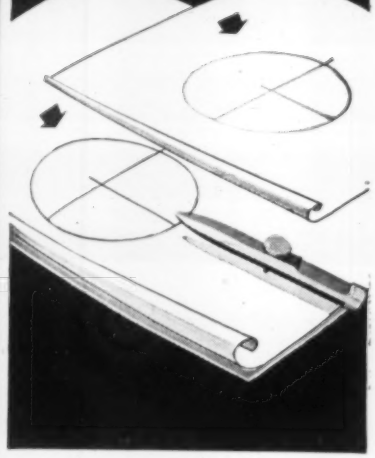

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CATALOG DIGESTS

89 PRECISION SURVEYING INSTRUMENTS

Brunson Instrument Company—Completely illustrated 2-color folders describing the operation and detail of Brunson ball-bearing engineers transits, light mountain transit, engineers dumpy level, engineers wye level, builders level, engraved permanent face level rods, and the new hand level are now available with pocket-size handbooks of operation, maintenance, and adjustment of Brunson ball-bearing transits and levels.

90 PRELIMINARY SURVEY PROCEDURE

American Paulin System—This booklet, available without charge to all civil engineers, is published in the interests of greater efficiency and economy of time and labor in the making of preliminary surveys under all conditions. The observer and author of this work, Raymond A. Hill, M. ASCE, explains in detail the practical use of the Paulin System Altimeter in connection with all branches of preliminary field surveying. Geologists, scientists, topographers, surveyors and educators will find this book of interest and technical value.

91 PROPELLER TYPE PUMPS

Economy Pumps, Inc.—Construction details, selection tables and station arrangements for axial flow and mixed flow-type pumps are shown in Bulletin No. G-845. These large capacity, low head pumps, suitable for flood control projects, drainage, irrigation, dewatering, and condenser circulation are available in capacities from 500 to 100,000 gal per min.

92 PROTECTIVE COATING

Amercoat Div., American Pipe and Construction Co.—Informational catalog showing causes of surface corrosion and methods of prevention through the proper use of Amercoat protective coatings.

93 REFUSE INCINERATION

Pittsburgh-Des Moines Steel Company presents a 24-page bulletin on municipal refuse incineration which discusses the problem of disposal of garbage and rubbish, gives data on per capita production of garbage and rubbish, describes incineration as a means of refuse disposal and sets forth the requirements for satisfactory incineration. It goes on to describe the Pittsburgh-Des Moines incinerator and includes typical plant layout, detail views which illustrate the operation and construction of the incinerator furnace, and photographs of 22 of their incinerators which are in successful operation.

94 RE-USE CONCRETE FORM PANEL

Harbor-Plywood Corporation—A pamphlet titled "Harborite, the Superior Multiple Re-use Concrete Form Panel" contains deflection charts, tables for maximum allowable loads, spacing of wales and studs, and similar data. The manufacturer produces three other types of form panels, viz., Super-Harbord Plycrete, Harbord Plycrete, and Harbor Plyform.

95 REVISED INSTRUMENT CATALOG

W. & L. E. Gurley.—A newly revised edition of the 50-page illustrated catalog describing a complete line of engineering instruments. Included are detailed analyses of transits, engineers' levels, precise leveling rods, alidades and topographic instruments and equipment. Also discussed and diagramed are several pattern designs of glass reticules. A section is devoted to available wind instruments.

96 REVISED STRADDLE TRUCK

Hyster Company—A new catalog describing the improved 18,000-lb capacity M3 straddle truck is available upon request. Rolling on pneumatic tires and powered by a gasoline engine, the new straddle truck is not larger than the 12,000-lb truck which it replaces, but will carry a heavier load because of its revised main frame structure and new hoist clutch arrangement. The versatile "Yardmaster," long used for lumber transporting, is constantly finding wider application in industries handling steel plate, pipe, oil drums, brick, and other unit-load packages.

97 ROOF INSULATION

Johns-Manville Corporation—A 4-page brochure, "Rock Cork Felt Sided Roof Insulation," is now ready for distribution. Photographs show this insulation being applied and illustrate its advantages. The text contains conductivity data and similar information of interest to roofing contractors and building maintenance men.

HYDRANTS & VALVES

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CATALOG DIGESTS

98 SEWAGE REGULATORS

Brown & Brown, Inc.—Bulletin 81 with supplements A and B describes sewage regulators designed to automatically control diverted sanitary flows from combined sewer systems either by cutting off such flows entirely during storm periods or by governing such diversions to a constant predetermined quantity regardless of storm conditions. Charts for the ready solution of diversion problems are included.

99 SEWAGE WORKS MATERIALS

Johns-Manville Corp.—Brochure TR 38A, in two parts, 78 pages, size 8½ × 11. Part one is an illustrated presentation of many actual applications of the various J-M asbestos products which have come to find broad application in the sanitary field. It includes sewer pipe, insulations, packings and gaskets, roofing and flooring, etc. Part two is a catalog containing descriptions of these products with recommendations for their use.

100 SIMPLEX EQUIPMENT

Simplex Valve & Meter Company—A general description of the complete line of Simplex equipment is offered in Bulletin 001. The bulletin describes and illustrates Venturi tubes, rectangular and circular chart type meters, controllers and gauges and methods of auxiliary close-off devices. It illustrates type "S" parabolic flume, W-K tap arrangements, manometers, pilot equipment, air inlet and air release valves.

101 SIMPLEX SOLAR SHIELD

Claude H. Wall—Engineers, surveyors and instructors will be interested in securing this booklet on a new device for Solar observations. The Simplex Solar Shield has been designed to give accurate results with the ordinary minute-reading transit and relatively greater accuracy with instruments of higher precision.

102 SNOW LOADER

Barber-Greene Company—An attractive, 2-color, 8-page brochure, No. SL-522, graphically describes operations and features of the new Model 522 snow loader. Controls, various operating features, and principles are adequately described. It requires a minimum initial investment and can be converted to an all-season bucket loader at a negligible cost.

103 SPEED PATROL

Allis Chalmers Mfg. Co.—An 8-page 2-color pamphlet is offered on the W Speed Patrol. Ditching, grading, maintenance and construction—all these jobs and many more make the new W Speed Patrol the most versatile light grading tool ever offered. Not only is it master of every maintenance and light grading job, but it is also a real money saver.

104 SPIRACTOR

Permutit Company—Bulletin 2384 outlines the principles and the design of the Spiractor. This new type of cold lime-soda water softener produces clear soft water in less than 8 min., operating on the principle of catalytic precipitation. It saves space, reduces chemical costs and cuts handling.

105 STEEL FOR HIGHWAYS

Bethlehem Steel Company—Catalog 191-A, a 26-page booklet, describes the various products manufactured by Bethlehem for use in the construction of streets and concrete highways, including reinforcing bars, structural steel, pipe, bar mats, mesh, dowel units, wire rope, highway guards and posts, and steel piling.

106 STEEL JOISTS

Laclede Steel Company—Containing detailed data on steel joists is a 4-page booklet entitled "Laclede Steel for Building Construction." The booklet explains three types of bearing ends for joists, purlins, and struts. A page is dedicated to various products manufactured by the company for building construction.

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107 STEEL JOISTS AND ROOF TRUSSES

Laclede Steel Company—A 4-page booklet titled "Laclede Steel Joists and Roof Trusses" is now being offered. Information on steel joist sections used as truss members in prefabricated roof construction is fully explained. Both products are being used for industrial plants, warehouses, stores, office buildings, and docks.

108 STEEL SHEET PILING

Carnegie-Illinois Steel Corp.—A 56-page booklet gives detailed discussion of the uses, characteristics, and assembly of the three general types of steel sheet piling sections; the straight web, the arch web, and Z-piles. Following this discussion are complete tables of wall dimensions, cellular structures, accessories, and weights for all sections, plus diagrams of the individual sections, walls, corners, cellular structures, cofferdams, bulkhead and piers, and caps or copings.

109 STRUCTURAL ARC WELDING

Lincoln Electric Company—A series of single sheets punched for notebook filing are sent free to architects, designers, structural engineers and fabricators. Current series on arc-welded beam and column framing gives design details of recently erected modern steel frame buildings. Accomplishment of these heavy beam and column details affords outstanding examples of sound engineering practice.

110 STRUCTURAL SHAPES

Carnegie-Illinois Steel Corp.—Attractive 72-page book, "Hot Rolled Carbon Steel Structural Shapes," contains complete properties and dimension tables of all available structural shapes, including diagram drawing of each. Also includes plate-size limitations and basic structural data on bearing piles, steel sheet piling, floor plate, crane rails, and corrugated sheets.

There are 147 Digest items on pages numbered 92 to 108. Read all items for the literature of interest to you.

CATALOG DIGESTS

111 SUBSURFACE EXPLORATION

The Giles Drilling Corporation—An 8-page pamphlet describes advanced subsurface exploration techniques in test borings for engineering. Emphasis is laid upon the fact that every engineering exploration presents its own individual subsurface conditions and problems. This places a premium upon correct field technique and interpretation.

112 SUMP PUMP

Gardner-Denver Co.—How the Sump Pump, operated by a vane type air motor, utilizes top suction to eliminate breaking the pump shaft seal by water pressure is told in a recent bulletin.

113 SURVEYING ALTIMETER DEVELOPMENT

American Paulin System—offers their interesting and instructive publication entitled "Origin and Development of the Barometer and Altimeter." This booklet will acquaint civil and field engineers with the basic differences between their system of instrumentation and all other types in the field of surveying altimeters.

114 SURVEYING ALTIMETERS

Wallace & Tiernan Products, Inc.—Technical information on W&T surveying altimeters and on surveying procedures for altimeters is now available in a handy folder. Results on some typical surveys are included together with complete specifications on new models of altimeters.

115 SURVEYING INSTRUMENTS

Keuffel & Esser Co.—Two booklets, extracts from K & E 40th edition catalog are offered. "K & E Engineers Surveying Instruments" describes in detail, with drawings of the parts, various transits, levels, alidades, and their accessories. "K & E Leveling Rods & Ranging Poles" describes and illustrates in color the construction of rods and poles, and lists accessories and replacement parts.

116 SWIMMING POOL EQUIPMENT

Permutit Company—Complete information and specifications are contained in Bulletin 2157 on Permutit recirculation and purification equipment. This includes information on alum and alkali feeds, filters, rate of flow controllers, automatic pH controls, chlorinators, test kits, suction cleaners and zeolite water softeners.

117 SWIMMING POOL EQUIPMENT

Worthington Pump & Machinery Corp.—A 16-page illustrated booklet, No. WP-1099-B56, describes the recirculating system, strainers, heaters, filters, underdrain system, flow indicators, control, and operation of Worthington swimming pool equipment. Also includes dimensional diagrams, typical filter installation plan, and circulating pump selection charts.

118 TECHNICAL AND INDUSTRIAL BOOKS

McGraw-Hill Book Co., Inc.—The 320-page 1949 general catalog contains detailed descriptions of over 2,500 technical and industrial books, among which are included more than 125 titles covering all phases of civil engineering. A free copy of this catalog will be sent you upon request.

119 TECHNICAL BOOKS

The Macmillan Co.—New 1949 descriptive catalog of technical and engineering books. Gives full details, including tables of contents in most cases, on our standard, recent, and forthcoming books in the fields of aeronautics, chemical technology, electrical engineering, electronics, radio and television, heating, ventilating and air conditioning, hydraulics and sanitary engineering, industrial management, machine and tool design, metallurgy, plastics, structural engineering, shop work, etc.

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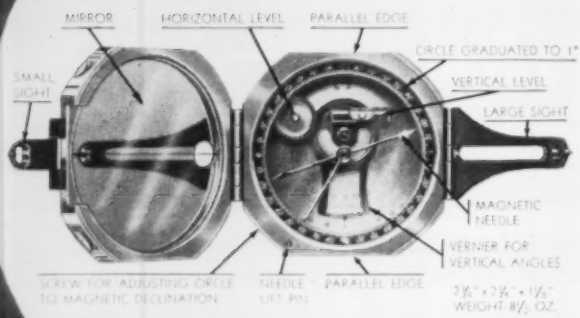

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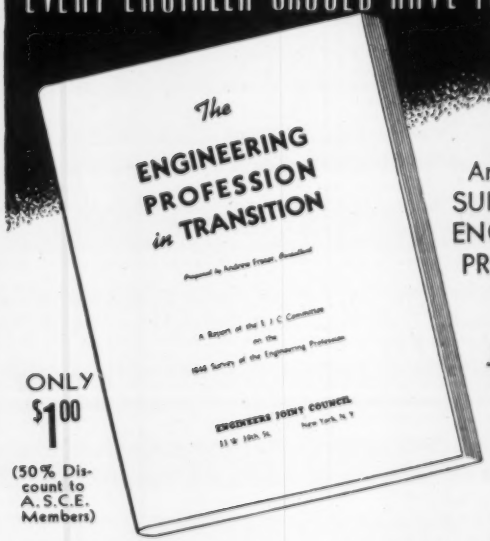

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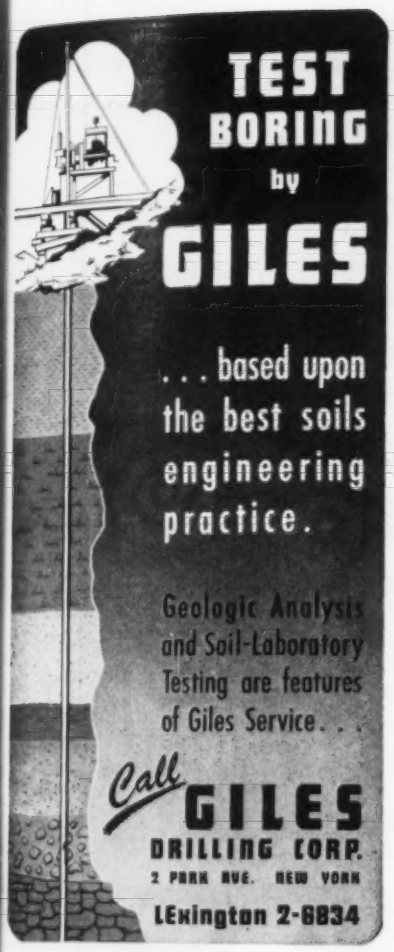

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CATALOG DIGESTS

120 TIDE GATES

Brown & Brown, Inc.—Bulletins 69 through 73, 75 and 76 describe various types of tidal gates, both circular and rectangular, and give authentic information regarding head losses.

121 TRACING CLOTH

Holliston Mills, Inc.—"Give them the 1-2-3 Test" is the title of a new practical demonstration-sampling folder for the quick and practical testing of Micro-Weave and Pel-X brands of tracing cloth. It is a direct-action folder specially designed to make it easy for designers, engineers and draftsmen to quickly test transparency, erasability, and non-feathering.

122 TRACTOR

Allis-Chalmers Mfg. Co.—A two-color folder announcing the new Allis-Chalmers HD-5 Diesel tractor and outlining several outstanding features. This tractor, engineered completely new throughout, offers grease-packed truck wheels that require greasing attention only once every 1,000 hours. A General Motors 2-cycle engine provides steady dependable power. A large 7 × 11-in. picture of the tractor illustrates its long rigid track that provides excellent ground contact, excellent balance and reliable traction. Other pictures point out full visibility, accessible controls, a convenient gear shifting arrangement and features that simplify maintenance problems.

123 TRACTORS

The Oliver Corporation—Recently published is an attractive 32-page booklet on the Oliver-Cletrac model A and B tractors. On-the-job photographs of both tractors in operation, specifications and various accessories that reduce over-all job costs are fully covered.

124 TRACTOR SHOVEL

The Oliver Corporation—Folder 450 explains the advantages of the new sargent overhead tractor shovel. This shovel is equipped with a "quick-change" connnection enabling the machine to be converted into a backhoe, log loader, bulldozer and anglegrader, as well as excavating, stock pile, shoulder, coal and snow buckets.

125 TRACTO-SHOVEL

Tractomotive Corp.—The newly organized Tractomotive Corp. of Findlay, Ohio, offers a folder on the new Tracto-Shovel. The Tracto-Shovel folder emphasizes the hydraulic bucket control of the new unit designed especially for the Allis-Chalmers HD-5. Film strip views and "action shots" depicting various applications of the Tracto-Shovel keynote the message of this bulletin. Several features mentioned are: the bucket can be dumped or closed at any height, automatic tilt-back avoids spillage, mounting of the unit on the HD-5 allows ample clearance and unobstructed vision, and hydraulic down pressure which offers unusual digging ability.

126 TRAVEL PLANT

Barber-Greene Company—offers Bulletin TP, a 2-color, 8-page, illustrated folder describing the "why" of the travel plant and highlighting the advantages of the plant. Fortified by four pages of Barber-Greene features, pictured with descriptions and tied to a flow diagram. Other bituminous mixing plants are shown.

127 1949 TRUCKS

Ford Motor Company—A comprehensive illustrated and diagramed folder presents the 1949 Ford Trucks. Discussed within the folder are special features, proof that Ford trucks last longer, "bonus built" construction, engine and cab features, and chassis and engine specifications. Each model is pictured and its particular features thoroughly explained.

128 TUNNELING

Armco Drainage & Metal Products, Inc.—"Tunneling for Profit and Convenience" is the title of a 4-page folder recently published. Stress is placed on tunneling as an economical means of avoiding inconvenience to traffic and loss of business to merchants and others. Uses illustrated are for new sewers, relining of failing sewers and culverts, service tunnels for utility lines and pedestrian and livestock underpasses.

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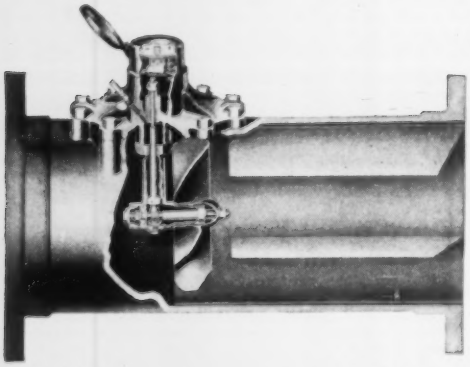

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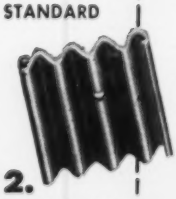

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CATALOG DIGESTS

129 UNDERWATER SURVEY INSTRUMENT

Bludworth Marine, Div. of National-Simplex-Bludworth—A brochure describing the Model ES-123 supersonic echo depth recorder and its application is offered. Survey groups and others engaged in dredging, excavation, and various silt studies will find this underwater survey equipment most interesting. The instrument provides a permanently recorded graph of underwater contours as well as the consistency of bottom materials.

130 VALVES AND FITTINGS

M & H Valve & Fittings Company—Catalog No. 34 is valuable to the engineer who is interested in various valves, hydrants and fittings. The booklet contains information on AWWA and low-pressure iron body gate valves, swing check valves, flap valves, mud valves, shear gates, compression type fire hydrants, and other water works equipment and accessories for distribution systems, filtration plants, pumping stations and sewage disposal plants.

131 VALVES AND FITTINGS

M & H Valve & Fittings Company—offers Catalog No. 30 which contains information on standard and extra heavy iron body gate valves, standard iron body swing check valves, cast iron flanged fittings and companion flanges for industrial piping systems.

132 VERTICAL BOOM DITCHER

Barber-Greene Company—A 4-page booklet, Bulletin No. 705, describes the runabout, a one-man machine, establishing a new standard of economy in ditching for gas, telephone, water, and power lines. By simply elevating the boom, the operator is ready to travel from job to job at 15 miles per hour. Upon arrival, the runabout is ready for work.

133 VERTICAL TURBINE PUMPS

Layne & Bowler, Inc.—Bulletin No. 4-42 describes a complete line of both oil and water lubricated vertical turbine pumps. Many illustrations and drawings give design and construction details of complete units and of various component parts. A "Useful Information" section contains weir and orifice tables for measurement of water, tables showing friction losses in pipe lines, hydrant and hose data and various other tables and data of interest.

134 VIBRATORS

Viber Company—An illustrated folder sets forth pertinent data on interchangeable vibrator units, flexible shaft, full depth internal concrete paving, rubber-tipped and Model PX-6 external vibrators. Specifications concerning speeds, weights, sizes, types of power, etc., are included.

135 WATER CONDITIONING DATA BOOK

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136 WATER FILTERS

%Proportioneers, Inc.%—Bulletin 1602-D describes Pur-O-Cel Diatomite water filters for use in swim pool recirculation systems. Engineering data on the application of these filters, including specification covering the complete recirculation and purification systems, are given.

137 WATER MEASURING EQUIPMENT

R. W. Sparling—A 20-page, 2-color booklet (Bulletin 310) gives complete descriptions of the various types of water measuring equipment. Diagrams of meters, station equipment, striptograph recorders and controls are included with charts and a price list.

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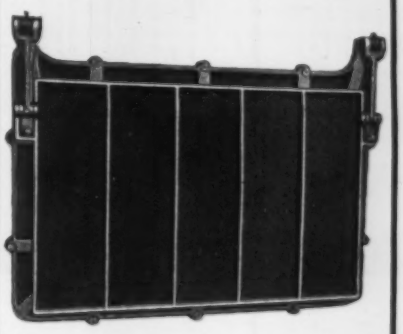

Fig. B-61. Type M-M

Type M-M (Rectangular) Tide Gates are available in 37 sizes from 8″ x 8″ to 96″ x 96″. Bulletin No. 71 describes them fully.

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